

THE PRESOCRATICS AND THE SUPERNATURAL

Magic, Philosophy and Science
in Early Greece

ANDREW GREGORY



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Science in Early Greece

Andrew Gregory

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For Sheelagh, with love

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Abbreviations

- KRS G. S. Kirk, J. E. Raven and M. Schofield, *The Presocratic Philosophers*, 2nd edn. Cambridge: Cambridge University Press.
- LSJ H. G. Liddle, R. Scott and R. S. Jones, *A Greek-English Lexicon*. Oxford: Oxford University Press, 9th edn, 1996.

Preface

This book is about the supposed presocratic rejection of the supernatural. I say supposed as the widespread view that a group of ancient Greek thinkers between the sixth and fourth centuries BCE rejected the supernatural has been subjected to considerable recent criticism. This book is a contribution to that debate. As such it looks at aspects of presocratic philosophy, religious belief and magical belief. It attempts to treat the issues broadly, by going beyond the canon of presocratic philosophers to look at some medical writers, historians and playwrights as well. This book makes no claim to be comprehensive on these issues (such a work would be many volumes) but I do hope to address the most important and interesting examples.

I have transliterated Greek terms, using circumflexes to mark long vowels (ê, ô) to keep the book as accessible as possible for those with little or no Greek. All Greek and Latin passages are translated and are my own translations except where otherwise indicated.

I would like to thank everyone I have discussed aspects of this book with and to audiences at the annual London Ancient Science Conference where I have presented some of the material here. I would especially like to thank Simon Trepanier, Leonid Zhmud and Phillip Horky who all sent me interesting material that they are working on prior to publication.

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Introduction

Behind its rather lurid title, what is this book about? It is possible to make a case that the presocratic philosophers attacked and entirely rejected the idea of the supernatural, believing what exists to be exclusively natural and that proper explanations of phenomena should cite natural entities only. This is called presocratic naturalism. One critique of this view is that the presocratic philosophers still believed in gods and the divine, that they believed in the efficacy of magical practices and that they indulged in animism, astrology, numerology, dream divination, magical healing and mysticism in their explanations of the world. The aim of this book is to investigate how far these criticisms are justified. It is common to find these criticisms made with the implication that the alleged belief entails a commitment to the supernatural and so a belief in an entirely natural world is compromised. It is rare to find this entailment spelled out in any detail or to find any discussion of how to distinguish between the natural and the supernatural, which we will look at later in this introduction.¹

The critique

Some readers will be more familiar with the complete rejection of the supernatural view for the presocratics, so let me say a little more to introduce the critique, which will also introduce some of the main areas of contention for this book. The basic assertion is that the presocratics did indeed believe in gods and various forms of magic and that this undermines any attempt on our part to construct a narrative of a rejection of the supernatural for this period. Historiographically, this has been supported in several ways. Dodds, in his *The Greeks and the Irrational*,² questioned why we should consider the Greeks different to other ancient societies and assembled impressive evidence of what he considered to be irrational beliefs among the Greeks.³ That we should not improperly privilege the Greeks has been an important theme in this critique, with Pingree and von Staden coining the terms ‘Hellenophilia’ and ‘Hellenocentrism’ respectively in this context. Both have argued that evidence of magical belief among the presocratics has been systematically underplayed,⁴ and the idea that some historiographies have either marginalised or ignored religious or

magical belief among the presocratics is central to this critique.⁵ Jaeger commented that religious belief is:

An aspect which has been unduly neglected or minimised by scholars of the positivist school because in the early Greek philosophy of nature they saw their own likeness.⁶

This issue of 'seeing their own likeness' has been applied to other historiographies,⁷ and one question is whether we have constructed a Greek rejection of the supernatural because we would like to see the Greeks as forerunners of our own rejection of the supernatural.⁸ Van der Eijk has argued that the persistence of the view that the Hippocratics offered natural instead of supernatural explanations for disease is at least in part due to institutional factors in the study of the ancient world, a point generalisable to presocratic philosophers and their supposed rejection of the supernatural as well.⁹

Lloyd has argued that the Greek conception of nature is in itself problematic. We must be wary of differences between Greek conceptions of *phusis* (usually translated 'nature')¹⁰ and our own conception of nature.¹¹ There was never *the* Greek conception anyway but many competing ones, all invented and not discovered, and as far as our evidence shows, generated in a context of polemic.¹² The polemical context might cause us to wonder how much conceptions of nature and supposed rejections of the supernatural were employed *ad hominem* rather than given as statements of principle. An important point made by Lloyd concerns what has been preserved of the presocratics' views on nature, upon which much of the rejection of the supernatural case is constructed.¹³ Were these views preserved because they were central concerns of the presocratics, or because they were central concerns of the doxographers? Given that much of the doxographical tradition on which we depend for information about the presocratics is itself dependent on the Aristotle/Theophrastus project of constructing a history of *phusikôn doxai*, '*Opinions on Nature*', we have to be concerned about what was and what was not selected to go into this work, and why.¹⁴ If what has been preserved reflects the doxographers rather than the presocratics' concerns then reliance and emphasis on these passages may be highly misleading, especially where the doxographers have stripped away the context for these passages.¹⁵

The counterpart of the critique of what *phusis* meant for the presocratics is a questioning of whether there was such a thing as the supernatural for them. Certainly it is the case that there is no Greek word for the supernatural.¹⁶ Martin has argued that the category of the supernatural was not available to the Greeks, explicitly or by assumption and that translating Greek terms like 'divine' as 'supernatural' is highly misleading.¹⁷ Martin has also questioned whether it is proper to think of Greek gods as intervening in nature as we might do if following modern notions of gods and the supernatural.¹⁸

Kingsley has argued that there is important evidence on the presocratics, especially Pythagoras and Empedocles, in the magical tradition, outside of the usual doxographical tradition of views on philosophy and nature.¹⁹ If we take this evidence into account then we obtain a much more magical view of the presocratics. Dodds, Kingsley and others have argued for the existence of shamen, holy men claiming to communicate with the dead when in ecstatic states among the presocratics.²⁰

At a more specific level, with Thales, Anaximander and Anaximenes the standard critique is that they all believed in gods or the divine and that this compromises any claim that they believed everything to be natural.²¹ There has also been considerable debate on just how different the views of the Milesians were from those of Homer and Hesiod.²² Important for the Milesians are a few passages giving what we interpret as natural explanations of meteorological phenomena. Lloyd's point about what has been preserved is particularly important here and two things remain to be shown. First, that there is an intentional rejection of the supernatural here, rather than a simple statement of or polemic about meteorology. Second, it needs to be shown that the rejection of the supernatural is universal to all phenomena rather than just specific to meteorology or some other subset of phenomena.²³

The Hippocratic texts have been a matter of ongoing debate, especially *On the Sacred Disease* and *On Regimen*. Edelstein makes the classic case that the Hippocratics retained a belief in the gods and the supernatural, more recently supported by Fowler and van der Eijk,²⁴ while Martin has argued that the Hippocratics believed in the activities of the gods and the efficacy of dreams but that supernatural is an inappropriate term.²⁵ That *On the Sacred Disease* is part of this debate may be surprising, as a common view is that it rejects a divine aetiology for disease. However, its view that all diseases are both divine and natural, the nature of its critique of magical healers and its attitude to purification rituals and piety have all been hotly contended. *On Regimen* IV, which appears to advocate prayer and divination as part of a healing strategy, has long been thought of as a difficult text for a purely natural reading and there are other difficult passages in the Hippocratic corpus as well.

The old view of Pythagoras as an innovative expert in mathematics and geometry, who emphasised the importance of a mathematical approach to cosmology and music has given way to a view of someone whose expertise was in the fate of the soul after death and in the nature of religious ritual with the work of Burkert, Huffman, Zhmud and others. It has been argued that metempsychosis, the transmigration of the soul on the death of the body could hardly be a natural process.²⁶ Dodds and Kingsley have argued that Pythagoras should be considered to be a shaman, someone who believes they can access the world of the dead by entering into ecstatic states.²⁷ Kingsley has argued that we should take some of the strange attributions to Pythagoras seriously (such as having a golden thigh) as these are indicative of an interesting relationship to Greek magic, ritual and ways to access the realm of the dead.²⁸ To what extent the Pythagoreans shared Pythagoras' own views has always been a contentious topic. It has also been argued that the Pythagoreans approach to number is that of 'number magic', 'number superstition' or 'number mysticism' rather than that of mathematics or geometry.²⁹

With Empedocles, there is evidence of views on the transmigration of the soul, on the efficacy of magic, on the purification of the soul, on magical healing, on bringing back from Hades the strength of a man who has died and of Empedocles regarding himself as some form of god among men and some form of divine prophet. All this is well known, but has been marginalised by the assumption that Empedocles wrote two poems, one on religion/magic (supposedly called *On Purifications*), the other an account of the natural world (supposedly called *On Nature*). There have been

strategies for privileging *On Nature* and marginalising *Purifications*.³⁰ However, recent developments in scholarship and historiography, and the discovery of the Strasbourg papyrus have all thrown doubt on whether Empedocles' thought was compartmentalised in this way and indeed even on whether he wrote two separate poems at all.³¹ This means that we need to deal with Empedocles' views on religion and magic as an important part of his overall thought and this will impinge on whether we consider Empedocles to have rejected all elements of the supernatural. Kingsley has argued for a strong relationship between Empedocles and the Greek magical tradition, and again that we should take some of the strange attributions to Empedocles seriously as these are indicative of an interesting relationship to Greek magic and ritual.³²

Even Leucippus and Democritus, sometimes taken as paragons of an entirely atomistic, mechanical and natural view have been argued to have a belief in gods and the divine and to have used biological analogues for the formation of the cosmos, allegedly compromising their supposed naturalism. The critique of the rejection of the supernatural view then is substantial both at a historiographical and at a specific level. It cannot be disarmed simply by citing passages of the Milesians on meteorology and the Hippocratics on disease as this evidence is hotly contested and there is much more evidence which needs to be taken into account.

Natural magic, natural theology?

In this introductory chapter I want to explore the ideas of natural and supernatural and the nature of the distinction between them. In relation to this it is important to look at how the presocratics characterised the natural and what they contrasted with it. I will also raise two important questions for this book. Can there be such a thing as natural magic? If the answer to this is yes (as I believe it is) then we need to look carefully at instances of magical belief to see if anything non-natural is involved. Second, can there be such a thing as a natural theology, in the sense that god or the divine is considered to be an entirely natural entity?³³ Again, if the answer to this is yes (as I believe it is) then we need to look carefully at instances of belief in god or the divine to see if anything non-natural is involved.

There are also some historiographical issues to look at. When we talk about the presocratics and a supposed rejection of the supernatural, it is important to be clear which of the presocratics we are talking about. Some historiographies have tended to marginalise magic and I want to clarify this book's attitude to evidence of the magical. I will also introduce an important theme for this book, which is that some presocratic thinkers deliberately targeted important, interesting or difficult-to-explain phenomena that had previously been given supernatural explanations, and in particular that they targeted famous passages in Homer and Hesiod. Finally, I want briefly to look at some historiographies of magic and some presocratic magical beliefs. I want to clarify my approach to magic in relation to these historiographies. It is also important to be able to generate a contrast between common magical beliefs and whatever magical beliefs may have been held by presocratic philosophers.

My own position

As this book has the word 'supernatural' in its title and deals to some extent with early Greek magical ideas, I want to make my own position clear on modern magic, the supernatural and associated ideas. I am an outright rationalist on these issues. As far as I am concerned, there is no basis for any of these beliefs. I am a sceptic in the strong modern sense that I not only doubt the claims of modern magic, but believe them to be false or impossible. Astrology in its modern form is a nonsense both theoretically and empirically.³⁴ Alchemy is only of historical interest as it has long been superseded by chemistry.³⁵ Transmutation of the elements is possible but only as specified by nuclear physics.³⁶ There are some interesting social psychology effects in magic but ultimately modern magicians are no more than conjurors who are skilled at working a crowd, or frauds.³⁷ Numerology, like astrology, is a theoretical and empirical nonsense.³⁸ The idea that water has memory, a basis for many modern magical beliefs, is simply false.³⁹ If asked for a dictionary definition of homeopathy, I would say 'the art of selling tap water at highly inflated prices'.

I find it highly significant that James Randi has a standing offer of a \$1,000,000 prize for anyone who can demonstrate a supernatural effect under agreed laboratory conditions. Very few have taken up the challenge and those who have, have failed dismally.⁴⁰ A standard and telling question in my view for anyone who actually believes they have a supernatural power is this: why are you bending spoons/holding séances/doing card tricks for a living when you could be doing something seriously beneficial for humankind or for yourself?

Philosophically, my view is quite straightforward. All that exists is natural. All that exists obeys natural laws. There are many things in this world which are fascinating, intriguing, beguiling, surprising, stunning, beautiful, etc. There are none which break the laws of nature. That, in many ways, is their fascination. Why then, one might ask, am I writing this book? Ancient magic, and the disciplines we associate with magic, such as astrology and alchemy, were significantly different from their modern counterparts and of course had a very different context. I am interested in how and why the presocratics formulated certain ideas and whether that committed them to a belief in the supernatural. I am also interested in how our terms natural and supernatural relate to the ancient context. I do not think we have been clear enough on these issues and I do think it matters for our understanding and evaluation of the presocratics.

Just before we begin to think about the nature of these issues and the evidence we have, I would like to emphasise a few things this book is not. This book is not a general survey of presocratic philosophy. Kirk, Raven and Schofield,⁴¹ Barnes,⁴² McKirahan⁴³ and Graham⁴⁴ are all excellent works in this respect. This book will barely mention the major philosophical theories of some people critically important to the history of presocratic philosophy (Parmenides, Zeno and Anaxagoras to name but three) and will be looking at the principal ideas of others as they relate to magic and theology rather than as key developments in ancient philosophy.

This book is not and does not claim to be a comprehensive treatment of the presocratics on magic, religion and other issues that might be thought to be related

to the supernatural. Such a project would be the work of many volumes. What I want to do in this book is to look at some important and interesting cases in relation to the presocratics. That involves looking at some people within the orthodox canon of presocratic philosophy (the Milesians, Xenophanes, Democritus, etc.). It also means looking at some people and material outside this canon. So I will be interested in the Hippocratics, in the Derveni Papyrus, in the plays of Aristophanes and Euripides, in the historian Thucydides, in the views of Homer and Hesiod and in some material from the magical tradition. I do want to look at some Greek magical beliefs as it is important, when arguing about the details of whether one person's views entail a belief in magic or the supernatural, to keep in mind as well the broader contrast of Greek magical beliefs and the tenor of presocratic philosophy.

This book is not an attempt, in some sense, to 'cleanse' the presocratics, the presocratic philosophers or those working in specific disciplines such as medicine of any belief in magic or the supernatural. Nor, may I add, is it an attempt to implicate all or as many as possible of the presocratics in some form of belief in magic or the supernatural. I am interested in reaching a better understanding of what the presocratics believed and the implications that had for them. Some of the analysis will be deflationary, in the sense that I will argue that we cannot infer from a belief in magic or a belief in some form of god or divinity directly to a belief in the supernatural. Indeed, in some cases I will argue that such beliefs actually affirm a commitment to an entirely natural world. On the other hand, I will be looking in some of the 'darker places' of the presocratics, at evidence and issues not often brought to light in modern discussions of presocratic philosophy and science.

This book is not committed to a simple *muthos* to *logos*, myth to reason account of the development of Greek thought in general or Greek philosophy in particular.⁴⁵ Nor is the book committed to, or an attempt to revive the notion of a Greek 'enlightenment', a large scale rejection of certain ideas leading to a rapid development of science, parallel to the Enlightenment of eighteenth-century Europe.⁴⁶ Nor is this book committed to the idea that there was a unitary origin for science and that was with the presocratics.⁴⁷ Finally, this book is not committed to the associated notion of a Greek 'miracle' – it would after all be rather odd if it was, given what I have just said about the supernatural!⁴⁸

Who were the presocratics?

An important question for this book will be which presocratics are we talking about? As a general definition I take them to be those people who were prior to Socrates and were speaking, writing and thinking in ancient Greek. 'Prior to Socrates' is rather loose. It could mean prior to Socrates' birth, his acme, his philosophical work, its impact on contemporaneous Greeks, its impact via the dialogues of Plato or his death. Actually nothing hangs on this for the purposes of this book and the latest figure I will consider will be Archytas who is roughly contemporaneous with Plato. Much more important is the issue of which of the presocratics we are talking about in this period.

Dodds' seminal book,⁴⁹ *The Greeks and the Irrational*, published in 1951, asked this key question:

Why should we attribute to the Greeks an immunity from 'primitive' modes of thought which we do not find in any society open to our direct observation?⁵⁰

While I have reservations about some of Dodds' terminology,⁵¹ I agree with his general conclusion. There is no reason to exempt the ancient Greeks from 'irrational' and 'primitive' beliefs and Dodds has brought together a large amount of evidence in support of his view. In relation to the key issue for this book, I do not want to deny that a large amount of the Greek populace, prior to Socrates and indeed after him as well, had a belief in the supernatural. There can be no doubt that they believed in the efficacy of magical practices founded on supernatural belief and they believed in gods with capricious wills and the ability to intervene in and override the natural order of the world about us.

Apart from the populace though, there were the presocratic philosophers and those investigating nature. The distinction between the groups was not sharp, as most presocratic philosophers had a good deal to say about nature and many of those investigating nature, some of the Hippocratic medical authors, were interested in philosophy as well. One can assert that the presocratic philosophers rejected magic and capricious, interventionist gods in favour of a view where all phenomena were seen as natural and were to be given entirely natural explanations. One issue for this book is how large a group of presocratics rejected the supernatural? This is why it is important to include people from outside the orthodox canon of presocratic philosophers.⁵² When we consider the views of the presocratics on magic and on the gods, does this group shrink to negligible size, or perhaps cease to exist at all? Or if we take on board presocratic attitudes to magic and the gods does this group expand in size?

To return for a moment to Dodds' terminology, I prefer not to use the terms rational or irrational in this sort of context. Irrational is ambiguous between 'lacking reason' and 'not conforming to the canons of rationality'. The latter does not entail the former. There have been many studies of magic in tribal societies where it has been shown that while their understanding of magical beliefs does not conform to the canons of rationality it does not lack reasoning or intelligence.⁵³ 'Irrational' is also too often taken as pejorative and is also often taken as 'completely irrational'. I would say much the same about the terms philosophical and pre-philosophical and the word 'primitive' and whatever we might contrast that with.

Natural and supernatural

What do we mean by supernatural and what is the distinction between the natural and the supernatural?⁵⁴ There are commonly two ways of characterising the supernatural:⁵⁵

- 1 That which is above or beyond nature.
- 2 That which is not subject to the laws of nature.

In my view neither is adequate and both could benefit from some further thought. The problem with (1) is that it does not tell us in what way a supposed supernatural entity is above or beyond nature. If we suppose for a hypothetical supernatural entity to be something which behaves in a law-like manner (it has its own laws) and can affect the natural but not break the laws of the natural, then that looks like just another piece of nature rather than anything supernatural.

One might take the view that the notion of 'above' gives us a hierarchical ordering. That may be so, but hierarchy on its own does not necessarily give us something supernatural, it may simply give us an ordered account of the natural. This is important in an ancient context as Aristotle might be seen to give us the latter alternative. The heavens are more actual and less potential than the terrestrial realm of earth, water, air and fire because aether is always executing its natural motion. There is though no sense in Aristotle that the heavens are supernatural.⁵⁶ They obey their own laws and while they interact with the terrestrial realm they cannot override the order of the terrestrial realm.

If one equates the natural with the physical then one might say that whatever is not physical is supernatural, as it is above or beyond the physical. There is no pressing reason to equate the natural with the physical though. I could be a realist on many philosophical issues without being committed to a belief in the supernatural. Perhaps the simplest example here is being a mathematical realist about numbers. I might believe that numbers exist but it does not strike me that there is anything supernatural about numbers. The ancient Greeks certainly could be realists about many issues without considering the entities they supposed to exist beyond the physical to be supernatural.⁵⁷ The notion of 'above or beyond nature' is then not very helpful, on its own, in characterising the supernatural.

The second sort of characterisation, that the supernatural is that which is not subject to the laws of nature. We can think about that in the following ways:

- a) The supernatural does not obey the laws which natural entities obey.
- b) The supernatural does not obey any laws.
- c) The supernatural can override natural laws.

The first of these looks like a *sine qua non*, for as with the discussion above, if something does indeed obey natural laws it is then just another part of the natural, and not supernatural at all. This then raises a question about the nature of the supernatural. Does it have its own laws? I think one can go either way on this, depending on one's attitude to (c). Certainly one can deny that the supernatural obeys laws at all. That is important for some modern conceptions of chaotic magic. It is also important for the ancient Greeks where the gods of Homeric myth do not seem to be bound by laws either in terms of what they can do or how they behave. There is an important contrast here with the Christian conception of God where God will always do what is good. One might accept that the supernatural has its own laws but also claim that the supernatural is capable of overriding or suspending natural laws.

It is also possible to approach the notion of the supernatural in terms of explanation, which helps to clarify related terms, paranormal and preternatural. Paranormal is usually taken to mean 'outside the range of normal experience or scientific explanation'.

Let us assume there is a phenomenon which defies current scientific explanation or which runs counter to current scientific explanation. The key question then is whether this is a reflection on our current scientific knowledge and with further advances in scientific knowledge we will be able to explain such phenomena, or whether there is something intrinsic here which defies, and always will defy scientific explanation. One way of forming the distinction between the preternatural and the supernatural is along these lines. The preternatural cannot yet be explained by science, the supernatural can never be explained by science.

The presocratics and nature

That, hopefully, clarifies our conception of what we mean by supernatural a little. What of the presocratic Greeks though? Did they even have a conception of the supernatural? The usual answer to this is that there is no word used by the presocratics which matches our use of supernatural.⁵⁸ They had the word *phusis*, meaning nature. They had and used the term *kata phusin*, according to nature. Aristotle uses *para phusin*, contrary to nature, but uses this to mean contrary to an object's nature rather than supernatural.⁵⁹ There is a Greek term *huper phusin*, above nature, which we can find much later in St. Cyril in the fourth century CE,⁶⁰ but not used in this way by the presocratics.

So is supernatural a proper term to use for the presocratics? I would prefer to talk in terms of the natural for the presocratics and whether they excluded the non-natural, anything that did not seem natural to them. So why do we need this discussion of the supernatural? The term supernatural has been widely used in the literature, both by those arguing for and those arguing against a belief in the supernatural for the presocratics. It is important to be clear about the nature and consequences of this debate and for that, we need to be clear about the term supernatural.

It is also important to be clear about the nature of the questions we are asking. The debates in some of the literature would lead towards formulating this question: Do we believe some of the presocratics to have rejected what we consider to be supernatural explanations? I would rather formulate the main question as: Did some of the presocratics consider themselves to have given only natural explanations? It is important that we recognise that those questions may have different answers. So does this book turn out not to be about the presocratics and the supernatural after all? In a sense no, as we will readily recognise as supernatural many of the explanations and entities which some of the presocratics reject as non-natural. I will also argue that what drives some of the presocratics is a commitment to the idea that nature is regular and exhausts what is, so that whatever might be thought to be irregular needs to be excluded as non-natural and so non-existent. Although not framed in terms of laws, this has significant similarities to the discussion above.

It is sometimes said that in order to have a conception of the supernatural one must have a conception of the natural.⁶¹ In order to give only natural explanations and to exclude non-natural explanations, and to do so consciously rather than accidentally,

there must be a conception of nature. The standard Greek term for nature, *phusis*, had a range of meanings. It could mean nature, as in the nature of something or somebody, or nature in the broader sense of all of the natural world. It can mean the 'regular order of nature',⁶² especially used in the phrase *kata phusin*, according to nature. It also has connotations of origin and growth,⁶³ 'the natural form or constitution of a person or thing as the result of growth'.⁶⁴ In common with many scholars, I take the presocratics to be talking about the origin and growth of something as well as its current nature when they talk of something's *phusis*.⁶⁵ This is why the presocratics were interested in so many agony disciplines, cosmogony, zoogony, anthropogony etc.⁶⁶

The presocratics' conception of *phusis* is then different from our conception of nature, though there are of course similarities too. It would be quite wrong, for instance, to translate the Greek *phusiologoi*, literally 'those who talk about nature' as 'physical philosophers' or even 'physicists'.⁶⁷ Aristotle also talks of *hoi phusikoi*,⁶⁸ 'the naturalists' and Plato speaks of *peri phuseôs historian*, the 'enquiry concerning nature'.⁶⁹ A very few presocratic thinkers may have been physicalists or materialists as we understand the terms, but most were not.⁷⁰ Some had a more organic conception of nature, many used biological analogues for the processes they saw around them. This did not prevent them from having an invariant conception of nature or giving explanations citing only natural entities. I have argued elsewhere that the Greeks used biological analogues for invariant behaviour.⁷¹ The very notion of *phusis* itself for the ancient Greeks is effectively an organic one of growth so biological analogues for them are simply not going to be non-natural.

Having adopted 'non-natural' instead of 'supernatural' should I use some other term for natural? I am going to stick with non-natural with the stipulation that this means that which is outside the presocratic view of nature. Was there a unified conception of nature among the presocratics, or even just the presocratic philosophers? That I think needs to be answered in two ways. As Lloyd has argued, there was no unanimity among the presocratics about the makeup of the world, no single concept of nature.⁷² Anaximander, Heraclitus, Democritus and Anaxagoras for instance all had quite different, incompatible accounts of how the world worked. On the other hand, one can argue that a significant group of presocratics had a shared sense of giving natural explanations to the exclusion of non-natural explanations and that they shared a sense of a regular order of nature. This is not to argue that all Greeks, or even all presocratics shared this view, just that a number of presocratics did. Indeed, there is an important contrast here. While Homer and Hesiod were of course aware of regularities in nature,⁷³ their gods were capricious. The gods were also capable of intervening in human affairs and in the regularities of nature. The idea of nature as invariant, that there is a regular order to all of nature is then a major move from the picture of Homer and Hesiod.⁷⁴

Lloyd has argued that the presocratic idea of *phusis* needed to be invented.⁷⁵ I would agree in the sense that the presocratics were pretty much the first Greeks to talk of *phusis*. The presocratics generated the notion of invariance for *phusis*. There is only one use of *phusis* in Homer, to describe a magical plant.⁷⁶ As Lloyd points out though, one use of *phusis* in relation to one entity does not give a general notion of *phusis* in the sense of all of nature.⁷⁷ That was something the presocratics had to generate for themselves.⁷⁸

The classic example of something non-natural for some of the presocratics is the interference of capricious gods in the physical and mental processes of the world. Meteorology, with the reasons for meteorological phenomena being the caprice and power of the gods is an important issue here. So one might think of the repeating motif in Homer's *Odyssey*, where by the rather spiteful will of Zeus a ship is hit by lightning generated by Zeus, a phenomenon which would not have occurred without the will or power of Zeus.⁷⁹ In Hesiod's *Theogony*, there is the battle of Zeus against the Titans where Zeus employs his weapons of thunder, lightning and thunderbolt.⁸⁰

One can have an ontology which consists entirely of natural entities, which one might call ontological naturalism. One can explain phenomena citing only natural entities, which one might call aetiological naturalism. I will use the terms 'naturalism' and 'naturalist' to refer to a position where both these views are held.

Natural magic

In the modern West, magic is typically categorised in one of two ways. It is conjuring in some guise, when it is not really 'magic' at all and can be explained in terms of the skill of the operator, physical science and social psychology. Alternatively, there is a claim that it is 'real' magic and that there is an involvement with the supernatural or paranormal. It is important to recognise though that there is another possibility, though it does not come easily to modern thinking, that of natural magic. Historically, there was a strong natural magic movement in the Renaissance. Giambattista della Porta, in his *Natural Magic*, says that:

There are two sorts of magic; the one infamous and unhappy, because it has to do with foul spirits, and consists of enchantments and wicked curiosity, and this is called sorcery, an art which all learned and good men detest... the other magic is natural, which all excellent wise men embrace, and worship with great applause.⁸¹

Elsewhere he says:

I never writ here nor elsewhere, what is not contain'd within the bounds of Nature.⁸²

The Christian context of the period required the development of the idea of natural magic. The Christian view was that humans do not have any magical power themselves. If anything happened which was contrary to nature, then there were two possibilities. Either God had worked a miracle through someone, or that person was in league with the devil and had derived the power to go beyond nature from the devil. To claim supernatural power was then to put oneself in a very dangerous position in the era of the witch hunt. If natural magic dealt with the natural world though, how did it differ from the science of the period? While science dealt with manifest phenomena, those that were directly observable or the causes of which were directly observable, natural magic dealt with what was hidden, with the occult. The occult here was simply what was hidden and had not accrued the modern connotations of evil or demonic. Natural

magic saw more connections between things than science, hypothesising harmonies, sympathies and correspondences. Natural magic also tended to believe that matter, without being alive or having intelligence, had more active properties. What must be emphasised here though is the commitment in the natural magic tradition to natural and law-like explanation.

What is important about this? First, that there can be such a thing as natural magic. Second, phenomena which we might consider to be supernatural could be given natural explanations. Third, phenomena which we now consider to be natural were at one stage considered magical. The prime example here is that magnetism was at one point considered to be an occult subject and part of natural magic and is now part of mainstream physics.⁸³ In relation to the ancient Greeks it is not enough simply to cite their belief in phenomena we would take to be supernatural in order to establish their belief in the non-natural. An important example here is the notion of sympathetic interaction. The classic statement of sympathetic interaction is that of Frazer:

First, that like produces like, or that an effect resembles its cause; and second, that things which have once been in contact with each other continue to act on each other at a distance after the physical contact has been severed.⁸⁴

Sympathy was used widely in Renaissance natural magic as a natural means of interaction. Objects which were in sympathy could affect each other even when separated. They could be thought of doing so in an entirely regular and natural manner. The Newtonian idea of gravity as a force which acted at a distance even though empty space separated the objects was influenced by this sort of notion of sympathy.⁸⁵ When we see something like sympathetic interaction supposed by the ancient Greeks, we cannot then immediately assume that this was a non-natural interaction. To quote Plotinus:

How is there magic? By sympathy, and that naturally there is a sympathy between like things and an antipathy between unlike things.⁸⁶

The Greek philosopher/scientists produced natural explanations of phenomena that their fellow Greeks considered non-natural.⁸⁷ They also accepted as real some phenomena which we would now dismiss, such as the role of amulets in healing. That they employed incantations or amulets does not entail that they believed in the supernatural. We need to know how they used them and what sort of explanations they gave for their effect.⁸⁸

One might agree that there was indeed a Renaissance Natural Magic tradition but be worried about how that might be applied to an analysis of Greek magic. Would it not be anachronistic to apply this category to the ancient Greeks? There are two sorts of reply to this. First, that the important issue here is simply to establish that there has been such a category of natural magic. There is no need to impose anything from the Renaissance on the ancient Greeks, least of all the religious framework. All we need to recognise is that it is possible for phenomena to be considered both natural and magical. That may occur in intellectual settings other than the European Renaissance. None of this is to say that the Greeks did consider some phenomena to be both natural and magical, or that they in any way had to. It merely raises the possibility and breaks the implication of magical belief therefore non-natural belief.

The second sort of reply is that the Renaissance natural magic tradition is related to ancient Greece. The theoretical underpinnings of all the key aspects of Renaissance natural magic, astrology, alchemy, the macrocosm/microcosm analogy, the notion of sympathy, the notion of harmony can all be traced directly back to the ancient Greeks. The dominant tradition was Aristotelian and we can find the basis of forms of astrology in Aristotle's cosmology, of Alchemy in Aristotle's theory of matter and of the macrocosm/microcosm analogy in Aristotle's meteorology. The notion of sympathy has its roots in the ancient idea of like to like found firstly in Democritus and Plato, in Aristotle as well and the idea of some form of celestial harmony can be found in the early Pythagoreans and Plato.

One chapter that may look slightly out of place in this book on the presocratics is the early chapter on Plato and Aristotle. What I want to do in that chapter is to try to show that Aristotle's cosmology and matter theory provides an entirely natural basis for astrology and alchemy. That may be a slightly surprising claim to some, but the evidence is clearly there. Two important points then follow from this. First, disciplines which we consider to be magical could be conceived of in an entirely natural way in antiquity. Second, that foundation for natural magic disciplines formed the basis of Renaissance natural magic. While Aristotle is the dominant influence here, it is possible to show something similar for Plato.

Natural gods?

Is it possible to have a belief in an entirely natural god, or something which is both divine and entirely natural? Christian theology, where it argues for a transcendent god which is separate from nature and which can override the laws of nature, would seem to exclude this. This tradition has had a powerful influence on our intuitions such that the idea of a natural god may seem a somewhat strange one. Given the conception of the gods in Homer and Hesiod it may have been a strange idea for the presocratic Greeks as well, but I will suggest that it was possible for them to believe in entities which are both divine and in an important sense natural.

Let us begin with three characterisations of God, related to the previous discussion of natural and supernatural, which I would take to be straightforwardly supernatural:

- 1 God is outside nature, God has the power to override the laws of nature.
- 2 God is outside nature, God behaves in an irregular manner.
- 3 God is outside nature, God behaves in an irregular manner and has the power to override the laws of nature.

The third of these I would take to characterise the gods of Homer and Hesiod. However, we might also consider this characterisation of God:

- 4 God is outside nature, God behaves in an entirely regular manner and has no ability to override the laws of nature.

This removes two of the key criteria for considering an entity to be supernatural. It would be at least debatable whether this sort of God was natural or not. We also need to consider this characterisation:

- 5 God is not outside nature, God behaves regularly and has no ability to override natural laws.

This removes all the criteria for an entity to be considered to be supernatural. It is then hard to see how a God so conceived would be anything other than natural. This is certainly not a vacuous case as one can formulate pantheism, loosely the notion that God is everything, in this manner. This is important for the presocratics as I will argue that some of them hold views with considerable similarities to pantheism. I will also argue something a little stronger, which is that for some presocratics the proper term is more like panpsychism, the idea that the cosmos has a soul or an intelligence. So one view we will need to investigate is that of Vlastos, who holds that:

In Ionian philosophy the divine is nature itself, its basic stuff and ruling principle. To say that the soul is divine is then to naturalize it; it is to say that it is subject to the same sequence of law and effect which are manifest throughout the whole of nature. And this is the very opposite of the Orphic doctrine of the divinity of the soul, whose content is rather obscure, but whose intent is perfectly clear: that the soul is not a natural, but a super-natural, entity.⁸⁹

Trepanier compares:

The more modern definition of God or a god as a supernatural agent with the options open to the Presocratics. In every case but that of the atomists, and perhaps even including them, the gods are always part of the natural order.⁹⁰

Some of the older literature holds that a key factor in the move from mythology to philosophy was a depersonification of the factors controlling the universe, a move from 'thou to it', to impersonal forces.⁹¹ I have argued elsewhere that the issue is really one of invariance rather than personification.⁹² One might have a depersonified force which is not invariant. One might have a God which itself behaves in a regular manner and which sees to it that the universe behaves in a perfectly regular manner.

It is interesting that St. Augustine discusses Varro's classification of pagan theology into three different types.⁹³ There is mythical (*muthikon*) theology, tales about the gods in the manner of Homer and Hesiod. There is civil theology, the common religion and rituals of the Greek city. Finally there is natural (*phusikon*) theology, theology as it is discussed by the philosophers. That is interesting in seeing a clear distinction between the gods of the philosophers and the god of Homer and Hesiod.⁹⁴ I strongly disagree with Dawkins, who has commented that:

Pantheism is sexed-up Atheism.⁹⁵

Whatever the case in the modern world, I will argue that this is false for the presocratic Greeks. There is an important explanatory content to their pantheism making it quite distinct from ancient atheism relating to how the cosmos obtains and maintains its

order. That matter can 'steer' itself in this regard marks them off sharply from ancient atheists and gives them an important critique of the atheists.

One theme of this book will be that presocratic intellectuals were capable of re-thinking theological and religious ideas to fit their new systems of thought. So we have the new pantheism to go with the new natural explanations. I will also argue that these pantheists believed they could be pious and could honour nature/god. Critical here is the Greek notion of the cosmos as something good and so worthy of reverence. So too I will argue that presocratic intellectuals could devise a form of prayer appropriate to their own philosophical/theological beliefs, rather than pray in the manner of popular Greek religion. This is important as some commentators, seeing expressions of piety or recommendations to pray, have inferred from these a belief in the supernatural. That is unjustified without a closer look at the beliefs in question.

This is also important in relation to magic. Theologies often set a framework for magic so new theologies may have new ways of theorising magic or excluding magic and the supernatural. Views on magic and the supernatural in the modern West have been very strongly influenced by Christianity.⁹⁶ Something that is true of ancient Greek theology generally is that their deities, either as part of a pantheon or single gods were not considered to be omnipotent. If we are interested in how widespread the rejection of the non-natural was, then the key question may be as follows. Did presocratic Greek intellectuals, using their own conception of god and their own criteria for natural/non-natural, to their own satisfaction show that there could be a belief in a god without a belief in the non-natural? I will argue that the answer to that, in many cases, is yes.

The historiography of the relation of religion and science has undergone a significant transformation in recent years. The conflict thesis, that religion and science are always in conflict, is now seen as outmoded and has been superseded by a complexity thesis.⁹⁷ In the complexity thesis religion may promote science, may be neutral to it or may be in conflict with it, depending on specific circumstances.⁹⁸ This is important for the presocratics, as we need not be forced into a polarity where religious belief conflicts with a belief in natural explanation or vice versa, forcing us to question the genuineness of the religious belief or the commitment to natural explanation. There is no need to argue then that where we find a commitment to natural explanation, any expression of a belief in god must be a matter of convention, to avoid religious prosecution and that behind this lies atheism or secularism. An important line for investigation will be that there can be genuine belief in natural gods and there can be genuine observance of religious practice relate to belief in natural gods. A second consequence of the move away from the conflict historiography is that we need not try to separate the 'religious' and 'scientific' aspects of a presocratic's thought. This is particularly important in relation to Empedocles, whose fragments have been rather arbitrarily sorted into a 'scientific' poem and a 'religious' poem.⁹⁹

Elisions?

This book, at least in part, is an experiment inspired by a reading of a critique of the way that we think about and relate to the ancient Greeks. The concern is that we have sought affinities between the ancient Greeks and ourselves and we put those affinities in the forefront of our account of the ancient Greeks.¹⁰⁰ We have tended to pass over or ignore the differences between the ancient Greeks and ourselves. So we privilege for instance the 'rational' parts of the Hippocratic corpus over the magical or religious parts or Ptolemy's mathematical astronomy of the *Suntaxis* over the astrology of the *Tetrabiblos*.¹⁰¹ The experiment then is this: What happens when we do feed in the material that is sometimes passed over, on astrology, dreams, divination etc? How far does that alter our picture?

There is also a more subtle issue of elision here, which while it applies to texts from all ancient periods, is perhaps more problematic with the presocratics due to our more fragmentary knowledge of them. There is a canon of presocratic material which we take to be genuine. The modern canon begins effectively with Diels' *Die Fragmente der Vorsokratiker* (The Fragments of the Presocratics)¹⁰² in the early twentieth century and current thinking is best represented by the excellent Toronto University Press Phoenix series on the presocratics.¹⁰³ Working within the canon, one can seek affinities and pass over some material. However, there is also a question of which material gets in to the canon of what are believed to be genuine fragments. So let me try to state something clearly:

The policy of this book is not to exclude material which gives some magical or non-natural belief to a presocratic *on those grounds alone*.

Otherwise, it seems to me, we pre-judge the very issues which are under examination in this book. Now, one cannot have an open door policy on ancient material and I readily accept that a good deal of material about the presocratics cannot be considered genuine. There are grounds of provenance, philology, dating etc. which will rule some material out. There is a great deal of doxographic material we must be suspicious of on the grounds of the doxographers' sources or their own agenda.¹⁰⁴

Is the exclusion of material due to magical or non-natural content a major issue? For many of the presocratic thinkers we are going to look at, no. However, when this sort of thing does occur, it can be a significant problem. What to accept about the early Pythagoreans is a major issue.¹⁰⁵ I will mention two specific examples here for illustrative purposes, which we will look at in more detail later on. There has been argument over whether Empedocles Fr. 111, which ascribes some apparently magical views to Empedocles, should be considered genuine or not, on the basis that there is nothing which expresses similar views in Empedocles.¹⁰⁶ An editor of the Hippocratic corpus has questioned whether a piece of text in *On Prognosis* was genuine, when it apparently expressed the view that diseases have something divine to them, on the basis that no Hippocratic would ever say such a thing.¹⁰⁷

A related issue here is that of how we treat a magical belief in a presocratic when we find one. Do we treat that on a par with other beliefs, or do we employ strategies which

keep magical and non-magical beliefs separate? Strategies here might be to assume that the magical belief belongs to an early or late period of the individuals thought, was part of a work with a different audience, or supposed schizophrenia.¹⁰⁸ Studies in the history of science on figures such as Ptolemy (astrology), Kepler (astrology), Harvey (macrocosm/microcosm) and Newton (alchemy) have shown that these figures believed their thought to be an organic whole of which the 'magical' part was integral to the rest. So unless there are independent grounds to believe otherwise, I will treat magical beliefs as integral to an individual's thinking. Given what I have said earlier about natural magic, this is often less problematic than it might initially be thought to be. Much of this applies to religious views as well. So I will not exclude material which gives some religious belief to a presocratic *on those grounds alone*, nor, in relation to what I have said earlier on religion, will I treat religious views as merely conventional unless there is good reason to do so.

A final thought on elision is about how we portray ourselves. We might like to think of ourselves, the humans of the twenty-first century, as people who have rejected supernatural explanations. Yet there are many who believe in astrology, mysticism, faith healing or a God who actively intervenes in the world. One could take Dodds' schema and apply it to the twenty-first century.¹⁰⁹ Despite that, there are people today who reject supernatural explanations. How many presocratic Greeks rejected non-natural explanation is something I hope to find out in the course of this book.

Targeting

One important thesis of this book will be that some of the presocratics targeted important, interesting or difficult-to-explain phenomena that had previously been given supernatural explanations. I hope to show that a wide range of presocratics targeted a wide range of supposedly supernatural phenomena. The classic example here perhaps is the Hippocratic *On the Sacred Disease* where the author discusses epilepsy and claims that this disease is not caused by the gods.¹¹⁰ I will try to show that there are many similar examples and that often the target of the attack is either the work of Homer or Hesiod, or both. One important part of this targeting thesis will be a strong assertion about Anaximander, which I will say a little more about below, but I will argue that there are many other examples of targeting in thinkers such as Anaximenes, Heraclitus, Xenophanes, Anaxagoras, Leucippus and Democritus as well as more examples in the Hippocratic corpus.

This targeting thesis is important because of some aspects of the new critique of the presocratics on the natural. One part of the critique is to argue that the presocratics had supernatural beliefs. Another is to argue that while there may be isolated cases of attacks on supernatural beliefs, these do not add up to a coherent, conscious, sustained rejection of supernatural belief. We moderns, the argument goes, seeing an affinity with the way that modern philosophy and science reject the supernatural, light upon some isolated cases, interpret them in a modern manner and give these instances privileged status in our account of the presocratics. In fact, the argument continues,

the supposed rejection of the supernatural is not so clear and these instances were not as significant to the presocratics as they may seem to us. We will need to look at these instances on a case by case basis, but if the targeting thesis is correct, especially in its stronger form, this will go a long way towards disarming this second part of the critique of the presocratics.

The other key point at stake in relation to the critique is the issue of polemical context. If the targeting thesis is correct, there is a polemical context for these passages and that is a rejection of the non-natural. So the rejection of the non-natural is not incidental to some other polemical context, it is the polemical context.

One criticism which might be made of the account which follows is that it treats the target of presocratic targeting as unitary, when in fact it is quite diverse. So one might, from the point of view of twenty-first century scholarship, want to differentiate between 'the poet of the Iliad' and 'the poet of the Odyssey' in giving an account of, say, the use of magic in Homer. One might also want to look more closely at the literary function of the use of the non-natural in Homer and Hesiod rather than take it literally in each case. I have not given a more intricate account here, partly because that is a considerable task in itself but mainly because this book is about how some presocratics reacted to Homer and Hesiod. It is their perception of the work of Homer and Hesiod which matters here, not ours. That perception could be quite unitary and blanket and a good example here would be Xenophanes Fr. 11:

Homer and Hesiod have ascribed to the gods all those things which are shameful and reproachful among men: theft, adultery and deceiving each other.

On the chronology of Homer and Hesiod, I am open and do not want to push a view that Hesiod is more philosophically sophisticated or forms a bridge between myth and philosophy and so must be later than Homer.

Historiography of magic

This book deals with aspects of Greek magic, but its arguments do not depend on any heavily theorised definition or conception of magic. Indeed, recent scholarship has come to doubt whether it is possible to give a single, all-encompassing definition of magic.¹¹¹ For the purposes of this book, I am happy for the presocratics to indicate what they think is magic and to avoid any discussion of whether they were correct to think of any particular instance as magical or not.¹¹² I agree with Collins that:

It has always been easier to define ancient magic by contrasts than in its essence.¹¹³

This is one reason why the next section is on Greek magical practice. As what interests me is whether certain presocratics thought their views were entirely natural or not, making a sharp demarcation between magic, religion and science is not a significant issue here.¹¹⁴ There is no single presocratic definition of or treatment of magic. This in some ways is a little frustrating, but is typical of magic in many cultures and time periods.¹¹⁵

I do have a few things to say about how we treat magic, to introduce a useful idea and to make my own view clear.¹¹⁶ Emanating from Levi-Bruhl, there is the idea of participation in an extended world. Some people believe that they live in a world which is richer in hidden powers, spirits and other entities than how we conceive the world. These people then participate in this world, employing what we would call magic in order to access, manipulate or entreat this extended realm. So Levy-Bruhl says that:

The things that a man has used, the clothes he has worn, his weapons, ornaments, are part of him, *are* his very self, just like his saliva, nail-parings, hair, excreta, although to a lesser extent. Something has been communicated to them by him which is, as it were, a continuance of his individuality, and in a mystic sense these objects are henceforth inseparable from him.¹¹⁷

Some people believe that the dead have not definitively left us, but live an afterlife, perhaps still living around us in spirit form, perhaps in another place. It may be possible for us to travel in spirit to the other place or for the dead who usually reside elsewhere to come among us. Again, with this world view one might employ magic in order to participate in it.

The importance of this for this book is twofold. First, it should be evident that Homer and Hesiod had extended worlds which will support the use of magic. Second, a key question for the presocratic thinkers we will be looking at will be did they subscribe to an extended world? Some chapters will begin by looking at ontology and asking does that ontology support the idea of an extended world or not? In relation to this it is important that for Homer the extended world supports intervention in the physical processes of the world but in the mental processes of humans as well. Dodds comments that:

The most characteristic feature of the *Odyssey* is the way in which its personages ascribe all sorts of mental (as well as physical) events to the intervention of a nameless and indeterminate daemon of 'god' or 'gods'. These vaguely conceived beings can inspire courage at a crisis or take away a man's understanding just as the gods do in the *Iliad*.¹¹⁸

Perhaps the most famous example of this in the *Iliad* is where Agamemnon, robbed of his lover by Achilles, steals Achilles' lover and then states that the cause of his behaviour was Zeus and the Erinyes taking away his understanding.¹¹⁹

One can characterise magic and science as opposites, what I refer to as the bi-polar approach. So on this view:

- 1 Magic is irrational, supernatural, superstitious, lacking any theoretical underpinning.
- 2 Science is rational, natural, evidence based, theory supported.

We could debate whether that is a fair characterisation of magic and science for the twenty-first century. Historically, it is extremely unhelpful. We have already seen enough of the natural magic of the Renaissance to recognise that it will simply not fit this sort of scheme. The historiography of the relation of religion and science has undergone a transformation in recent years, moving away from ideas of inherent antithesis between religion and science.¹²⁰

The historiography of the relation of magic and science has undergone similar changes. There has been a move away from a bi-polar characterisation of magic and science to more complex models.¹²¹ Magical disciplines are seen as broad churches, done by a wide variety of people for a wide variety of reasons. The theoretical bases for these disciplines is also seen to be very varied, ranging from the minimal or the mystical through to justification in terms of the leading philosophical or scientific theses of the time, as we will see in relation to Aristotle. So as I term it, magical disciplines contain a 'broad spectrum' of views on how that discipline works. Some of these views will be natural, some non-natural, to us or to the people who held them. This notion of broad spectrum will be important when we come to look at numerology. It has been held that either we have numerology, which is primitive superstition, or we have modern mathematics and mathematical physics. I will argue that there is interesting ground between the two, ways of thinking about how numbers relate to epistemology and cosmology, which was exploited by some of the Pythagoreans. One of the problems of the bi-polar view, or views which characterise science as rigidly mechanical or positivist, is that they deny the existence of any such interesting ground.

Greek magical practice

Finally for this introductory chapter, I want to look briefly at a few magical frameworks and magical practices for the presocratics. I make no attempt to be comprehensive here. I just want to give a sense of some of the world views and practices that some of the presocratics will react against. Of key importance here are the writings of Homer and Hesiod. It should be clear that both Homer and Hesiod portray extended worlds as discussed in the previous section. The Gods intrigue against each other and intervene in the affairs of mortals. Xenophanes' criticism that the gods of Homer and Hesiod are guilty of 'theft, adultery and deceiving each other' can hardly be denied.¹²² While the dead do not live about us, the underworld is accessible under certain circumstances. So Odysseus in *Odyssey* XI manages to summon the dead, by digging a trench, pouring libations of milk, honey, wine and water around it and sprinkling barley meal. He slaughters two sheep and allows their blood to run into the trench.¹²³ In Hesiod's *Works and Days*, the first humans were the golden people and after their death they lived on as good spirits on the face of the earth, watching over mortals.¹²⁴ Dreams are seen as important and prophetic and are often sent by gods.

On some more specific instances of magic or divine intervention, in both Homer and Hesiod, diseases are caused by the gods, the plague in the opening passage of the *Iliad* and Pandora's box in *Works and Days*.¹²⁵ There could be magical healing too though, as in *Odyssey* XIX where Odysseus tells the tale of how when he was young he was gored by a boar and the flow of blood was staunched by an incantation being sung. In *Odyssey* X, Circe uses drugs and a wand to transform men into pigs.

In terms of magical practices, verses from Homer were used as healing incantations for a wide range of maladies.¹²⁶ The general use of incantations in healing was widespread. The idea of personal purification was also seen as important in combating

disease. Those claiming foresight were also commonplace, as were people claiming to be able to interpret prophetic dreams. There were means of attempting to bring on such dreams, involving ritual, diet and prayer.¹²⁷

A common form of magic was that of binding, particularly the binding curse.¹²⁸ Typically this was in one of two forms. The binding spell could be written, perhaps on wax or a piece of broken pot but most often on thinly rolled lead. The lead might then be rolled up and pierced with a nail. Alternatively, a doll might be used, loosely resembling the person the spell was aimed at, made of fabric or wax, or perhaps clay such that the limbs could be bound. These dolls too might have nails put through them. There was a relatively standard language for the binding spell, and the binding required the aid of divinities for it to work. Typically these curses were placed in wells, or some place appropriate to the curse. Many were placed on the graves of those who had died young or who had met a violent end, whose spirits were thought to be restless on account of the injustice of their death. Here again we see the idea of an 'extended' society including the dead. Not all binding magic involved curses. Some was amorous, intended to lead the victim to do something, though some of this magic could be quite malicious as well.¹²⁹

There was then a considerable range of magical beliefs among the presocratics, ranging from the literature of Homer and Hesiod, to how that literature was used in the common magic of healing practitioners, seers, witches, necromancers and the practice of binding magic. Ogden's sourcebook of *Magic, Witchcraft and Ghosts in the Greek and Roman World* is an excellent read for an impression of the nature and diversity of magical thought and practice in ancient Greece.¹³⁰

Some new interpretations

Having gone through the broader historiographical issues, I would just like to introduce three important more specific new interpretations this book has to offer. The first is that a key passage on meteorology in Anaximander, giving natural explanations for five phenomena alludes to a famous passage in Hesiod where the same five phenomena are given non-natural explanations. If that is so, it has considerable consequences in establishing a context for polemic and intentional rejection of the non-natural. It is also significant in that several other presocratics give natural explanations of these five phenomena, especially as it is hard to believe they would be ignorant of the allusion to Hesiod, Anaximander's intentions or the polemical context. It is possible to discern a tradition of discussion of these phenomena in the presocratics following on from Anaximander at least Anaximenes, Heraclitus, Anaxagoras, Leucippus and Democritus and probably Xenophanes as well. If so, we have an important tradition of targeting meteorological phenomena involving many of the presocratics.

Second, it has been suggested before that a form of pantheism might fit some of the Hippocratic writings. I argue that we can have an account of the Hippocratics as naturalists without marginalising or ignoring the religious practice that is suggested in some Hippocratic works. It is possible for pantheists to honour god/nature, to have a pious attitude and to criticise atheists. Important here is the Greek notion of

the cosmos as something not merely well ordered but good. It is also possible, with a broader understanding of prayer, for pantheists to pray, not for an independent god to intervene, but as an action to bring themselves in tune with god/nature. This has an important consequence in that the Hippocratic *On Regimen*, and especially *On Regimen* IV, have been thought impossible to give a naturalist reading to as it advocates prayer and divination. Here I argue that if we pay close attention to the Greek and the context, *On Regimen* IV is critical of any non-natural conception of divination while giving a natural explanation for an ability to predict the future.

Third, the literature has previously treated ancient numerology as an undifferentiated whole. Here I argue that there are some significant differences between types of ancient numerology and that this is crucial in understanding what some of the early Pythagoreans were doing. If we take a bi-polar approach of mathematics and modern mathematical physics on the one hand as proper use of number, and group together all numerologies as improper uses of number we are liable to gloss over interesting aspects of the early Pythagoreans. Here I argue that between modern views on the application of number and early 'superstitious' numerology, there is interesting ground which some of the early Pythagoreans exploit in terms of epistemology, music theory and cosmology.

Plato and Aristotle

It may seem strange to open a book on the presocratics with a chapter on Plato (428/7–348/7 BCE) and Aristotle (384–322 BCE), but there are good reasons for this. I will argue that although they are not often thought about in these terms, their cosmologies and matter theories give the basis for belief in an entirely natural astrology, alchemy and the macrocosm/microcosm analogy. If this is true, why is it important for this study? It establishes the possibility of belief in an entirely natural astrology, alchemy and macrocosm/microcosm relationship. If so, we cannot move from ‘x believed in astrology, alchemy or the macrocosm/microcosm relationship’ to ‘x believed in something non-natural’. It is important to show that this sort of belief was possible in close temporal proximity to the presocratics and may indeed have grown out of presocratic thinking. It opens up the possibility that other disciplines and beliefs which we consider to be magical or non-natural could also be given a natural foundation. It establishes an important link between on the one hand Plato and Aristotle and on the other the Renaissance natural magic tradition who also took astrology, alchemy and the macrocosm/microcosm analogy in an entirely natural manner. It establishes that having the theoretical basis for astrology, alchemy or the macrocosm/microcosm relationship does not entail practice in those areas, either natural or non-natural, a point that will be important in looking at some presocratic thinkers.

I am conscious that, in relation to some ancient philosophers, I am not playing to the most receptive of audiences on these issues and that more sceptical readers may have some worries at this stage. Should those paragons of the rational philosophical tradition, Plato and Aristotle, really be associated with (or tarnished by their association with) astrology, alchemy and the macrocosm/microcosm analogy? So let me be clear and emphatic on some issues. I am not claiming that either Plato or Aristotle should be in any way associated with modern takes on astrology, alchemy or the macrocosm/microcosm analogy. As I made clear in the introductory chapter, there are major differences between ancient and modern views of these issues. I am not even claiming that either Plato or Aristotle was an astrologer or an alchemist. Nor am I claiming that they used the macrocosm/microcosm analogy in the manner of ancient magical practitioners or the manner that became common in the Renaissance natural magic tradition. The claim is merely that one can use the cosmologies and

matter theories of Plato and Aristotle to underpin a belief in astrology, alchemy and the macrocosm/microcosm analogy. This is actually a stronger position to defend a fully rational, fully natural view of Plato and Aristotle from. It is not open to the elisions objection, that we have picked the parts of Plato and Aristotle we find rational and have passed over the other parts. A further aim of this chapter is to establish that it was possible to theorise or philosophise about magical disciplines and that magical disciplines could be an integral, rather than a peripheral part of someone's philosophy. The theoretical basis for some magical disciplines is clearly integral to Plato and Aristotle. It is now commonly acknowledged that the Renaissance natural magic tradition sought the theoretical basis for magical disciplines in Aristotle and Plato.¹ We will also look briefly at Bruno and Harvey, two Renaissance thinkers where magical disciplines were integral to their picture of the world.

Astrology

Apart from arguing that the basis for astrology in Plato and Aristotle is natural, I also want to view it in relation to a comment by Dodds in his *The Greeks and the Irrational*:

Besides astrology, the second century B.C. saw the development of another irrational doctrine which deeply influenced the thought of later antiquity and the whole Middle Age – the theory of occult properties of forces immanent in certain animals, plants and precious stones.²

Clearly, Dodds sees astrology as an irrational doctrine. I'm not going to discuss later Greek astrology to any great extent in this book, but if I did the issues would in some ways be a microcosm of this book's arguments about the presocratics. I would not want to argue that all belief in astrology after the second century BCE was rational. Rather, I would argue that a group of people, including some important people such as Ptolemy, held a belief in astrology which did not entail any non-natural belief or even natural magical belief and was based on an entirely natural cosmology, most often in this case that of Aristotle. Outside these views, there was a spectrum of other views on astrology, ranging from astrology based on natural magic views through to outright non-naturalism and mysticism. So I would reject the old view that astrology:

Fell upon the Hellenistic mind as a new disease falls upon some remote island people.³

There was a wide variety of reactions to the introduction of astrology, some of them based on the entirely natural foundation for astrology one can find in Aristotle.

A final reason for this chapter is to look at Aristotle's views on the natural. Aristotle held that what happens 'for the most part' happens '*kata phusin*', according to nature, while it is possible for some things to happen '*para phusin*', contrary to nature. There is no sense in Aristotle though that anything is non-natural, even though it may be *para phusin*.⁴ A stone moving upwards is *para phusin*, but stones may be made to do this under compulsion. One reason why this is important is that Aristotle held a

hierarchical view of nature. The celestial realm differed from the terrestrial realm, being constituted from a different sort of matter, aether as opposed to earth, air, fire and water. Aether always executes its natural motion, is always actualising its potentiality such that the heavens for Aristotle are in a sense more actual and so in a sense higher in the order of nature. There is no sense though that anything non-natural happens in the celestial realm for Aristotle. On the contrary, as there is no change in the celestial realm and the motions are entirely natural, everything that happens in the celestial realm happens *kata phusin* for Aristotle.⁵ It is also important that for Aristotle there is his god, the prime mover. This god does nothing but actualise its potential, carrying out the highest activity of thinking about thinking. Similar considerations apply as with the celestial realm, only more so. There is no sense that this god does anything non-natural, quite the contrary, what it does is entirely *kata phusin* for Aristotle. So one could, in the ancient world, have a hierarchical view of nature, and even a belief in a form of deity, without having any belief in the non-natural.

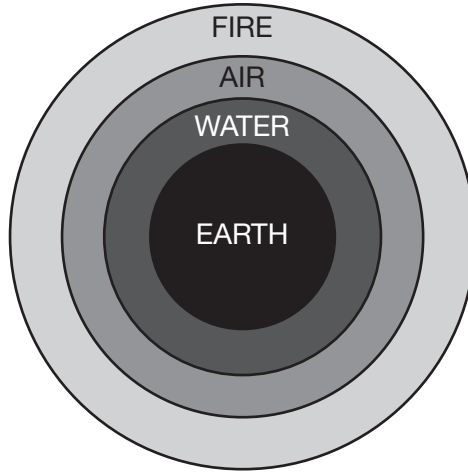
As above with astrology, alchemy and the macrocosm/microcosm relationship, this establishes the possibility of belief in an entirely natural hierarchical conception of nature and an entirely natural god. Again, it is important to show that this sort of belief was possible in close temporal proximity to the presocratics and may indeed have grown out of presocratic thinking. One final point on Aristotle is that he frequently uses biological analogues as paradigms for explanation. One can argue that this includes Aristotle's physics to some extent. Even if this is so, this does not compromise either his belief in regular behaviour or his belief that everything in one sense is natural.

Aristotle and astrology

There are two groups of passages in Aristotle which are significant in relation to astrology, in *On Generation and Corruption* book II chapters 10 and 11, and in *Meteorology* book I chapters 1–3. In *On Generation and Corruption* Aristotle conducts a thought experiment. He says that:

The problem some see arising here is now solved, that is how each of the bodies (i.e. earth, water, air, fire) travelling to their own places have not, in an unlimited amount of time, become separated from the other bodies. The reason for this is that they change into each other. If each had remained in its own place without change they would have separated long ago. They are though changed due to the double motion and because they are changed none is able to remain in any ordered place.⁶

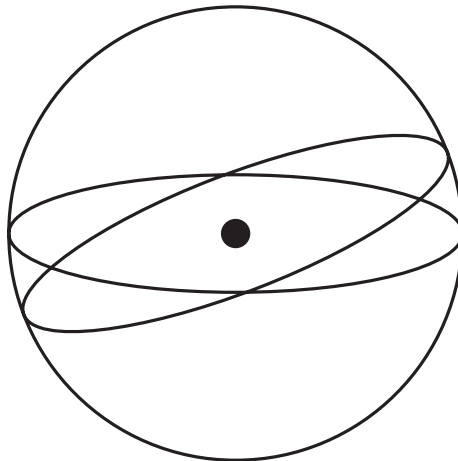
The problem for Aristotle is that the elements, earth, water, air and fire all have natural motions, earth and water towards the centre of the cosmos, air and fire away from it. Left to themselves, they would separate out with earth in the centre and the other elements in concentric shells, like this:



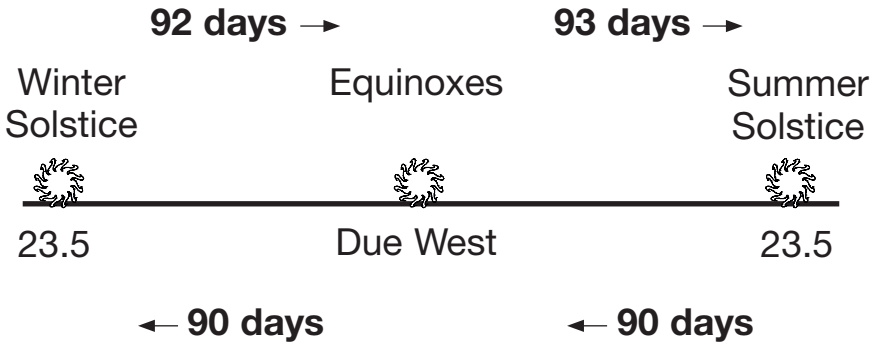
As for Aristotle there is a beginning to the cosmos, there is adequate time for this to have happened already. As it has not, there must be something opposing this tendency. Aristotle's examples of elements changing into one another are air from water, fire from air and water from fire.⁷ Why is it that this change occurs and what is the double motion that is referred to here? Aristotle says that:

It is not the primary motion which is the cause of generation and destruction, but motion on the inclined circle.⁸

This needs a little explanation in terms of Aristotle's geocentric cosmology. For Aristotle, the sun has two circular motions around the centre of the cosmos.⁹ The first of these motions is the primary motion of the cosmos, around the earth in a single day. The second circular motion is inclined to the first and the sun completes this circle in one year. Although we have no precise information on the angle between these two motions, it is generally presumed that this represents the angle of the ecliptic to the earth's equator.



One important effect of the second motion is that it generates a reasonable approximation of where the sun will set on the Western horizon throughout the year. The values for the length of the seasons here are those of Euctemon and Meton.



It was common in the ancient world to refer to the sun as approaching as it moved from winter to summer solstice (days are longer and warmer) and receding as it moved from summer solstice to winter solstice. Aristotle says that:

It [the sun] generates by approaching and being near, it destroys by withdrawing and being far away ... Therefore the lifespan of each living thing has a number and is determined. There is an order for all things and all lifespans have a measurable period.¹⁰

He also says that:

It would seem that the empirical evidence agrees with our theory, as we see generation with the approach of the sun and destruction with its withdrawal.¹¹

The second Aristotle text is the *Meteorology*:

The entire terrestrial realm is composed of these bodies [earth, water, air, fire], and as we have said it is the processes which affect them that concern us here. This realm is of necessity contiguous with the upper motions, which means that all of the motions here are steered by the upper motions. As the source of all motion, the upper motions must be accounted as the primary cause. These are eternal, unlimited with respect to place but are always complete. In distinction, all of the other bodies comprise separate regions from each other. The result of this is that fire, earth and their kindred must be accounted as the material reason for coming to be, while the ultimate reason for their motion is the motive ability of the eternally moving things.¹²

The upper motions here are the motions of the heavens. That the terrestrial motions are 'steered' (*kubernasthai*) is interesting here. *kubernēin* is not a simple verb of motion (which Aristotle could easily have used here) but means to steer, as in to steer a boat, or to guide or govern in a political sense.¹³ As with the passages from *On Generation and Corruption* then, the heavens have a significant effect on the terrestrial realm. How is this actually mediated? Aristotle says that:

The circular motion of the primary element and the bodies which are in it, are by their motion always separating, setting on fire and making hot the contiguous bodies in the lower realm.¹⁴

How the heavens affect the upper parts of the terrestrial realm in Aristotle has been the subject of much debate, though it is clear that Aristotle believes there is such an effect. Clearly, Aristotle is not an astrologer in that he makes no mention of the zodiac or its houses, no mention of birth/conception dates and does not see human fate or character influenced or determined by the heavens. Aristotle's concern here is to but to solve a paradox in his theory of motion given the eternity of the cosmos rather than establish a basis for astrology. However, did Aristotle believe that the heavens determine the seasons, the behaviour and lifespan of animals, that all generation and destruction is related to the position of the sun and that the celestial motions 'steer' the terrestrial motions.

A few more passages on Aristotle and astrology, firstly from the *Metaphysics* on the causes of human beings:

The cause of man is (1) the elements in man (viz. fire and earth as matter, and the peculiar form), and further (2) something else outside, i.e. the father, and (3) besides these the sun and its oblique course.¹⁵

Aristotle naturally emphasises the role of the sun in relation to the terrestrial realm in his cosmology, but the moon has a role too, as this passage from the *Generation of Animals* shows:

The moon is a first principle because of her connexion with the sun and her participation in his light, being as it were a second smaller sun, and therefore she contributes to all generation and development. For heat and cold varying within certain limits make things to come into being and after this to perish, and it is the motions of the sun and moon that fix the limit both of the beginning and of the end of these processes.¹⁶

Aristotle relates the moon in particular with the behaviour of women:

The period is not accurately defined in women, but tends to return during the waning of the moon. This we should expect, for the bodies of animals are colder when the environment happens to become so, and the time of change from one month to another is cold because of the absence of the moon, whence also it results that this time is stormier than the middle of the month.¹⁷

Finally, Aristotle relates the behaviour of the sea-urchin with the moon in the *Investigation of Animals*:

As a general rule, the testaceans are found to be furnished with their so-called eggs in spring-time and in autumn, with the exception of the edible urchin; for this animal has the so-called eggs in most abundance in these seasons, but at no season is unfurnished with them; and it is furnished with them in especial abundance in warm weather or when a full moon is in the sky.¹⁸

While Aristotle did not have a horoscopic astrology himself, Aristotle's basis for astrology was developed into a full horoscopic astrology by Claudius Ptolemy in

his *Tetrabiblos*. Ptolemy also wrote the *Almagest*, the definitive ancient work on astronomy. Ptolemy distinguished between astronomy and astrology at the start of the *Tetrabiblos*, astrology being:

That through which we investigate the configurations themselves and the specific changes they bring about in what they surround.¹⁹

Ptolemy also says that:

A certain natural power emanates from the eternal aether and affects the entire region of the earth, subjecting all to change.²⁰

The sun is always in some way changing (arranging) all that is on earth, not only through the changes of the seasons of the year bringing about the generation of animals, the growth of fruit bearing plants, the flowing of waters and the returning of bodies, but also through its daily cycle producing heat, moisture, dryness and cold in a regular manner.²¹

While Ptolemy develops a horoscopic astrology, it is still Aristotelian in its foundation and involves no non-natural ideas or even sympathies or harmonies. The effects of the heavens on the terrestrial realm are entirely natural for both Aristotle and Ptolemy. That is important to point out, as it is often said that astrology is fundamentally grounded in the 'ancients' magical world view'.²²

Aristotle and alchemy

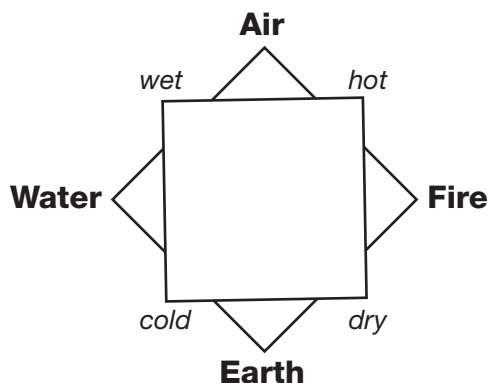
It is possible to argue many of the same things about alchemy for Aristotle as about astrology. Aristotle's theory of matter laid a basis for an entirely natural conception of alchemy that was taken up by many in the alchemical tradition after him. Martin comments that:

It has been well demonstrated that alchemists appropriated *Meteorologica* IV both in the Middle Ages and in the early modern period.²³

Aristotle himself though was not an alchemist either in the modern or ancient senses. Again it is crucial to appreciate how the ancients saw alchemy. It is important to recognise that ancient alchemy was not solely about the transmutation of base metals into gold, as the Leyden papyrus amply demonstrates.²⁴ It was rather more about the transformation of raw materials into something more useful or valuable. So the Leyden papyrus outlines processes for generating gold, but also has processes for generating silver bronze, gems and dyes.

Within Aristotle's theory of matter, there is nothing which prevents transmutation, and indeed transmutation was a commonplace phenomenon.²⁵ It is also an entirely natural process, in many senses of 'natural'. Primarily for us, transmutation for Aristotle occurs without any non-natural entities intervening and without any magical processes. Transmutation is also natural in the sense that it occurs in nature without the intervention of human beings. Finally, transmutation is also natural in

the Aristotelian sense in that in given circumstances it is what happens for the most part. One can think of this in three ways. Physically, there is nothing which prevents the four Aristotelian elements of earth, water, air and fire from transmuting into each other, as the contraries underlying them (hot, cold, wet dry) alter.



Aristotle's Elements.

Each element is characterised by a pair of the wet/dry and hot/cold opposites.

An important example of consistent, natural transmutation of the elements (in all three senses outlined above) for Aristotle is the weather cycle, where water heated by the sun turns into vapour, is cooled and then falls as rain.²⁶ If we want to think of transmutation in terms of the classic alchemical project of the transmutation to gold, gold is constituted out of these elements,²⁷ so the transmutation from non-gold into gold is at least a theoretical possibility.²⁸

If, alternatively, we think in terms of matter and qualities, gold has a certain set of qualities. All qualities are mutable for Aristotle. One might then begin with a plentiful substance that is reasonably similar to gold (e.g. lead), sharing many of the same properties but differing in a few, and seek to change the relevant qualities until one has gold.²⁹ This was a view taken up by many early alchemists. Also significant here for the alchemical tradition was Aristotle's notion of prime matter, that is matter which has been stripped of all its qualities. For Aristotle this was an abstraction which could not actually exist, but some alchemists sought prime matter, or as close as they could come to it, as a starting point for alchemical transformation. The idea was that with as neutral a starting point as possible, it would then be easier to induce the qualities that they wanted in a substance. Within this project, the reaction of burning Copper with Sulphur to form a black powder was thought significant, as important qualities, such as metallicity and colour appeared to have been removed.

A final way of thinking about transmutation for Aristotle is that he held that geologically, metals were formed in the ground.³⁰ Again, this is an entirely natural process, with no non-natural intervention, no intervention by humans and in the given circumstances happens for the most part. If metals are formed in the ground then there is a process by which they are formed from non-metals. Aristotle held that metals were formed from the moist exhalation of the earth.³¹ One might then seek to identify, isolate and replicate this process as part of alchemy.

Aristotle and the macrocosm/microcosm analogy

The macrocosm/microcosm relationship is important for a good deal of natural magic theory. The basic idea is that there is some form of relationship between the cosmos as a whole, the macrocosm, and some smaller part of it, the microcosm, typically but not exclusively a human being. The first occurrence in Greek thought is generally reckoned to be with Democritus, who said that:

Man is a small cosmos (*anthrôpôi mikrôi cosmôi*).³²

We will return to look at this in the chapter on Leucippus and Democritus. This though does not yet give us the full macrocosm/microcosm terminology. Aristotle did not discuss the relationship between macrocosm and microcosm in the abstract at any point. The closest he came to such terminology is in the *Physics*, when discussing self-motion he says that:

If this can happen to a living thing, what prevents the same thing happening to the universe? If this can happen in the small world (*mikrô kosmô*) it can happen in the large (*megalô*).³³

In *On Generation and Corruption* II/10 and 11 we find the comparison of the cycle of the heavenly motions and the weather cycle, the weather cycle being said to ‘imitate’ the heavens.

The cause of this perpetuity of coming-to-be, as we have often said, is circular motion: for that is the only motion which is continuous. That, too, is why all the other things – the things, I mean, which are reciprocally transformed in virtue of their ‘passions’ and their ‘powers of action’ e.g. the ‘simple’ bodies imitate circular motion. For when Water is transformed into Air, Air into Fire, and the Fire back into Water, we say the coming-to-be ‘has completed the circle,’ because it reverts again to the beginning. Hence it is by imitating circular motion that rectilinear motion too is continuous.³⁴

This is a passage which was much referred to by the natural magic tradition as a prime example of the macrocosm/microcosm analogy in Aristotle. The notion that the earth’s weather cycle was a microcosm of the macrocosmic motions of the heavens was common in the natural magic tradition, as was the idea that the flow of the blood around the human body was a microcosm, this time with the earth’s weather cycle as the relative macrocosm. Again, we can note that for Aristotle the motions of the heavens and the earth’s weather cycle are both natural in a strong sense. They are both what happens for the most part and so both are *kata phusin* for Aristotle. It is important to recognise that there were a wide range of macrocosm/microcosm theories with a wide range of supposed relationships between the macrocosm and microcosm. One can, as an elementary explanatory device, say that the electrons of an atom orbit the nucleus as planets orbit the sun and vice versa. One can draw this analogy without suggesting that there is any special relationship between planets and atoms or sun and nucleus. There is no necessity to suggest any causation from

planets to electrons, or any harmonic attunement shared by them, or any sympathetic interaction. The natural magic tradition would suppose many types of relationship between the macrocosm and microcosm, such as sympathies and harmonies and of course one can suppose non-natural relations between the two.³⁵ There could also simply be correspondence between macrocosm and microcosm. The macrocosm and microcosm would have similar structures but there would be no causal relationship (no sympathy, no harmony) between them. In this case macrocosm and microcosm would be set up by a benevolent deity during cosmogony. In our case here, Aristotle has the microcosm imitating the macrocosm. I take it as uncontroversial here that Aristotle's microcosm does not consciously imitate but functions as if it does.

Aristotle on dreams

Aristotle is also the author of what might at first seem a rather strange little work, *On Divination by way of Dreams*.³⁶ The interpretation of dreams was held to be important in many contexts as they were thought to in some way foretell the future. The provenance of these dreams was commonly thought to be non-natural. Some god had sent the dream, or the person was blessed with foresight. Aristotle seems a little perplexed in the opening passage of *On Divination by way of Dreams*, as it seems to him there is some basis for divination from dreams but at present no plausible explanation of it:

Concerning divination which occurs in sleep and which is said to arise from dreams, it is not easy either to reject it or to accept it. The fact that everyone, or at any rate most people, suppose there to be something significant about dreams gives the view a certain empirical credibility; nor is it incredible that in some cases there should be divination through dreams, since they have a certain rational structure, and hence one might suppose the same might be true in the case of other dreams as well. On the other hand, the absence of any plausible explanation for the phenomenon tends to discredit it: for in addition to its general implausibility, it is absurd to suppose that a god is the source of such things, and yet that he sends them not to the best and the wisest people, but to anybody at all. Yet if we abandon the divine explanation, none of the others seems reasonable; for it is beyond our understanding to explain how anyone could foresee things occurring at the Pillars of Hercules or on the Borysthenes.³⁷

Aristotle's attitude is very interesting here. He is loathe to believe that there is a non-natural explanation here even if there seems to be some basis for divination. So at this stage he treats divination by dreams as preternatural – there is some natural explanation but as yet we do not know what. That is useful in confirming that in other situations, with astrology, alchemy and the macrocosm/microcosm analogy, Aristotle is not interested in any non-natural explanation. In *On Divination by way of Dreams* Aristotle does ask though:

Are then some dreams causes, and others signs, for example of what occurs in the body? At all events, even reputable doctors say that one should pay close attention to dreams.³⁸

Aristotle gives a natural explanation of some veridical dreams. Dreams say of thunder and rain may be caused by our faint hearing of thunder and lightning during our sleep.³⁹ Aristotle also has the following sensible comment to make:

Most [so-called prophetic] dreams are, however, to be classed as mere coincidences, especially all such as are extravagant, and those in the fulfilment of which the dreamers have no initiative, such as in the case of a sea-fight, or of things taking place far away. As regards these it is natural that the fact should stand as it does whenever a person, on mentioning something, finds the very thing mentioned come to pass. Why, indeed, should this not happen also in sleep? The probability is, rather, that many such things should happen.⁴⁰

The following passage also indicates a rather sceptical attitude on Aristotle's part:

On the whole, forasmuch as certain of the lower animals also dream, it may be concluded that dreams are not sent by God, nor are they designed for this purpose [to reveal the future]. They have a divine aspect, however, for Nature [their cause] is divinely planned, though not itself divine. A special proof [of their not being sent by God] is this: the power of foreseeing the future and of having vivid dreams is found in persons of inferior type, which implies that God does not send their dreams; but merely that all those whose physical temperament is, as it were, garrulous and excitable, see sights of all descriptions; for, inasmuch as they experience many movements of every kind, they just chance to have visions resembling objective facts, their luck in these matters being merely like that of persons who play at even and odd. For the principle which is expressed in the gambler's maxim: 'If you make many throws your luck must change,' holds in their case also.⁴¹

As Hankinson has pointed out, there are some interesting parallels with the Hippocratic *On the Sacred Disease* here.⁴² The Hippocratic author argues that epilepsy (the 'sacred disease') cannot be sent by a god, as we would then expect equal incidence of epilepsy through the population.⁴³ In fact some types of people are more prone to it and the divine causation model cannot account for this demographic. At the end of *On Divination by way of Dreams* Aristotle develops a natural theory of how prophetic dreams which are not mere coincidence might come about:

As for [prophetic] dreams which involve not such beginnings [sc. of future events] as we have here described, but such as are extravagant in times, or places, or magnitudes; or those involving beginnings which are not extravagant in any of these respects, while yet the persons who see the dream hold not in their own hands the beginnings [of the event to which it points]: unless the foresight which such dreams give is the result of pure coincidence, the following would be a better explanation of it than that proposed by Democritus.⁴⁴

The details of Aristotle's scheme here need not concern us and we will see Democritus' theory later on in this book. What is important here, as Huby points out, is that:

Like later theories of the same kind, it does not explain everything, and in particular is no help towards understanding precognition, but for us the important

point is that it is intended as a natural, scientific explanation which will replace the traditional supernatural one.⁴⁵

I include this material on dreams in Aristotle for several reasons. It establishes that in antiquity, directly after the presocratic period it was possible to have an entirely natural explanation of supposedly prophetic dreams. It rounds out our picture of Aristotle as someone who gives entirely natural explanations, whether that concerns the astrological aspects of his cosmology, the alchemical aspects of his matter theory, his use of the macrocosm/microcosm analogy or here, his treatment of prophetic dreams. Finally, as with astrology, alchemy and the macrocosm/microcosm analogy, we will be looking at dreams in relation to the presocratics.

William Harvey and Aristotle

I want to make a very brief excursion into the Renaissance, to show how influential Aristotle's thinking on macrocosm/microcosm, alchemy and astrology was in the Renaissance natural magic tradition and even with people who we would more straightforwardly associate with an orthodox history of science. William Harvey discovered the circulation of blood, probably in the late 1610s. It is now commonplace for scholars to recognise that Harvey was a dedicated Aristotelian and a great deal of the motivation for his study of the heart and circulatory system came from his reading of Aristotle.⁴⁶ One issue for Harvey, in breaking from the Galenic view that there were two types of blood in two separate systems in the body, was how the two types of blood could convert into one another within a unitary circulatory system, in the absence of any modern understanding of oxygenated and deoxygenated blood. His answer was to use a macrocosm/microcosm analogy. As the macrocosm, the earth's weather cycle saw the sun heat water and turn it into vapour, the vapour then cooled and fell as rain, ran through land to the sea, and was heated again. As the microcosm, the heart heated the blood, converting it to nourishing blood, while the blood was cooled in the periphery of the body, converting it back again. Harvey says that:

So the heart is the beginning of life, the Sun of the Microcosm, as proportionably the Sun deserves to be call'd the heart of the world, by whose vertue, and pulsation, the blood is mov'd, perfected, made vegetable, and is defended from corruption and mattering; and this familiar household-god doth his duty to the whole body, by nourishing, cherishing, and vegetating, being the foundation of life, and author of all.⁴⁷

He also says of the motion of the blood around the body:

Which motion we may call circular, after the same manner that *Aristotle* sayes that the rain and the air do imitate the motion of the superiour bodies. For the earth being wet, evaporates by the heat of the Sun, and the vapours being rais'd aloft are condens'd and descend in showrs, and wet the ground, and by this means here are generated, likewise, tempests, and the beginnings of meteors, from the circular motion of the Sun, and his approach and removal.⁴⁸

After Harvey published on the circulation of the blood, for a few years there was debate as to whether this new idea should be accepted. Some of his supporters made considerable use of this macrocosm/microcosm analogy.⁴⁹ On astrology, Harvey takes up very much the same position as Aristotle, that the heavens guide the terrestrial realm and that the motions of the sun and moon in particular are implicated in the reproduction of animals.⁵⁰ Harvey translates and quotes a long passage by Aristotle in relation to astrology.⁵¹ Harvey's description of how the two types of blood change into one another draws on standard alchemical terminology for the time, which is heavily influenced by Aristotle's theory of matter. Some of Harvey's supporters were quite clear that this was indeed an alchemical change, and Waleus tells us that in relation to Harvey's circulation theory:

Hence a kind of circulation operates, not unlike that by means of which chemists utterly refine and perfect their spirits.⁵²

In the terminology of the seventeenth century, a 'chemist' is an alchemist. There is never any sense in Harvey of anything non-natural occurring, and his use of the macrocosm/microcosm analogy, astrology and alchemical terminology are all entirely natural and are tightly related to his adherence to Aristotelian ideas.

Plato and natural explanation

It is also possible to find an entirely natural basis for astrology, alchemy and the microcosm/macrocosm analogy in Plato. Plato also has some interesting things to say about the natural. In the *Timaeus*, Plato is keen to give natural explanations for some important phenomena. He tells us that:

The flowing of waters, the fall of thunderbolts⁵³ and the wonderful attraction effects of electricity⁵⁴ and the magnet,⁵⁵ all these are not due to any power of attraction, but to the fact that there is no void and that the particles push into each other.⁵⁶

This is interesting in several respects. Firstly, thunderbolts were held by Homer and Hesiod to be non-natural phenomena, and as we shall see in later chapters, giving them a natural explanation was an important topic for many presocratic thinkers. Here though, Plato explains the thunderbolt in terms of his geometrical atomism, even if the explanation is hardly a full one. These phenomena are not to be explained by any action at a distance, but by the interaction of particles and the fact that particles will always fill a void.⁵⁷ That we can explain electricity and magnetism in this manner is also significant. Both might be thought to be difficult to explain by purely natural means in an ancient context and Aristotle tells us that:

Thales supposed the soul to be capable of generating motion, as he said that the magnet has soul because it moves iron.⁵⁸

We will discuss whether that constitutes a non-natural explanation when we get to Thales but it is interesting to note that Plato gives electricity and magnetism entirely

natural explanations. At *Timaeus* 71aff. Plato attempts to give a natural explanation for the possible use of the liver as a source of divination, something that was common among the Babylonians. Divination and dreams will be an issue when we come to the Hippocratics and we have seen Aristotle's attempt at natural explanation.

Plato also has some interesting things to say about magic in the *Laws*. He distinguishes two sorts of poisoning, and having described the normal kind, he says:

Distinct from this is the type which, by means of sorceries and incantations and spells (as they are called), not only convinces those who attempt to cause injury that they really can do so, but convinces also their victims that they certainly are being injured by those who possess the power of bewitchment. In respect of all such matters it is neither easy to perceive what is the real truth, nor, if one does perceive it, is it easy to convince others. And it is futile to approach the souls of men who view one another with dark suspicion if they happen to see images of moulded wax at doorways, or at points where three ways meet, or it may be at the tomb of some ancestor, to bid them make light of all such portents, when we ourselves hold no clear opinion concerning them. Consequently, we shall divide the law about poisoning under two heads, according to the modes in which the attempt is made, and, as a preliminary, we shall entreat, exhort, and advise that no one must attempt to commit such an act, or to frighten the mass of men, like children, with bogeys, and so compel the legislator and the judge to cure men of such fears, inasmuch as, first, the man who attempts poisoning knows not what he is doing either in regard to bodies (unless he be a medical expert) or in respect of sorceries (unless he be a prophet or diviner).⁵⁹

Plato, like Aristotle, uses the terms *kata phusin* and *para phusin*. As with Aristotle, *para phusin* is often paired with *kata phusin* and *para phusin*, while taking the usual sense of 'contrary to nature', never has the sense of non-natural. So at *Cratylus* 393bc there can be unnatural births, at *Philebus* 32a what is unnatural to the body causes pain, at *Republic* 444de health is natural and disease unnatural (cf. *Timaeus* 81eff.) and at *Laws* 795a ambidextrousness is natural and we only become dominant handed through practice.

That Plato considered material explanations to be inadequate to explain some phenomena does not mean that the explanations he did employ were non-natural. Forms may be of a different order of entities to physical objects, but could hardly be thought of as non-natural, as they have invariant natures of their own and specific ways of relating to physical entities. Often cited in this context is the fact that Plato believed that the heavenly bodies had souls. However, these souls behave in an entirely invariant manner. So Plato says in the *Laws*:

Those who engaged in these matters accurately would not have been able to use such wonderfully accurate calculations if these entities did not have souls.⁶⁰

In the *Timaeus*, there is a hierarchy:

A motion proper to its body, that of the seven motions which is best suited to reason and intelligence. Therefore he made it move in a circle, revolving of itself

uniformly and in the same place, and he took from it all trace of the other six motions and kept it free from their wanderings.⁶¹

To each of these he gave two motions, one being uniform and in the same place, always thinking the same thoughts concerning the same things, the other being a forward motion obeying the revolution of the same and similar. With regard to the other five motions, they were motionless and still, in order that each might attain the greatest possible perfection.⁶²

Given that these planetary souls obey their own invariant nature, are they non-natural or just another part of nature? The other issue here is that in the *Phaedo*, Plato has Socrates express his dissatisfaction with the types of explanation given by the natural philosophers.⁶³ Are the new teleological explanations though in any way non-natural? We might similarly look at the different types of explanations offered in the *Timaeus* and the difference between reason and necessity.

Plato, astrology and macrocosm/microcosm

Plato's cosmology was used as a basis for astrology in two separate ways. First, Plato's cosmos was generated by a benevolent god in the best manner possible. One way of thinking about astrology is that the heavenly bodies are not causes of what will happen on earth, but are signs of what will happen. If the cosmos has been put together by a god who cares for human beings, then that god may also have taken forethought about the heavens such that they may be read as signs of what will happen by humans. I do not see any indication of this sort of astrology in Plato, but it is easy to see how this can be built in to derivative cosmologies. The second way in which Plato's cosmology was used as a basis for astrology was via the macrocosm/microcosm analogy. Plato did not use the macrocosm/microcosm terminology, but in the *Timaeus* there are important and highly influential accounts of the relation of humans to the cosmos. The key here is that the human mind is put together in the same manner as the world soul. Just as the world soul is constituted out of sameness, being and difference and has two circuits, one of the same and one of the different, so the human mind has two circuits as well. The cosmos, having been brought into being by a well meaning craftsman with only the best in mind,⁶⁴ is a living, intelligent, ensouled entity. The heavenly bodies, which are alive, intelligent and ensouled and execute (combinations of) regular circular motion, are the visible manifestation of the intelligent life of the cosmos. The *Timaeus* then tells us that:

God devised and gave to us vision in order that we might observe the rational revolutions of the heavens and use them against the revolutions of thought that are in us, which are like them, though those are clear and ours confused, and by learning thoroughly and partaking in calculations correct according to nature (*kata phusin*), by imitation of the entirely unwandering revolutions of God we might stabilise the wandering revolutions in ourselves.⁶⁵

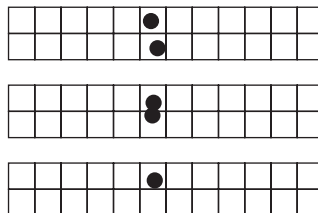
Bound up in this is the standard Platonic moral injunction that we strive to become as much like god as possible. Humans should also imitate the cosmos to maintain good health. The *Timaeus* tells us that the cosmos has a rocking motion, and as the cosmos keeps itself in motion in order to sustain its own good order, so should humans take a moderate amount of exercise in order to sustain their good order (which equates with their good health).⁶⁶ Indeed, we can also find a macrocosm/microcosm analogy directly to do with the blood in Plato. Just as the cosmos confines and agitates the particles within it, so does the human body confine and agitate the blood.⁶⁷

One way of developing an astrology out of this is to suppose that changes in the macrocosm cause changes in the microcosm. One can do that by supposing some form of sympathetic relationship between the position and motion of the heavens and the circuits of the human mind. Did Plato himself believe in astrology? I would answer a firm no to this. There is no system of physical influence from the heavens to the terrestrial realm as we find in Aristotle, nor are there the occasional comments about the influence of the sun or the moon. One can just about get some form of astrology out of one of the mythological passages of the *Phaedrus*,⁶⁸ but it is generally accepted that this is part of the mythology and not a part of Plato's description of the world about us.⁶⁹ The most interesting passage in the *Timaeus* is 40c:

The dances of these stars and their juxtapositions with one another, the circling backs and advances of their own cycles, which of these come into contact with each other and which into opposition, which cover each other relative to us, and for what periods they each disappear and again re-appear, sending fears and signs of future events to men who are unable to calculate – to describe all this without visible models would be hard work indeed.⁷⁰

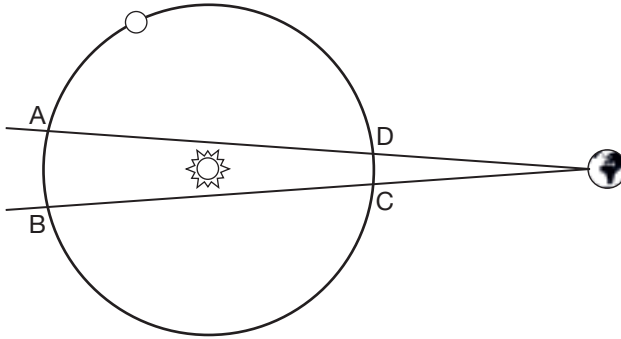
I have argued elsewhere that this is the proper translation for this passage and that Plato displays a good knowledge of assorted celestial phenomena here.⁷¹ In particular, he seems to be aware of the phenomena when planets come into conjunction. Planets may pass each other and still be distinct, may appear to touch each other and become one large object or one may cover the other for one small object.

Possibilities for planets passing each other in the zodiac.



An important phenomenon in Babylonian astrology is that the inferior planets,⁷² Mercury and Venus, will at times disappear from view as they orbit the sun, being too close to the sun in angular terms to be seen from the earth. They will reappear again on the other side of the sun, and the Babylonians were very good at predicting

the times and periods of invisibility. They also saw great astrological significance in whether Mercury or Venus could be seen. This may well be the phenomenon that Plato is referring to in the later part of *Timaeus* 40cd.



So while Plato himself did not have a belief in astrology, he was aware of phenomena others took to be astrological and it was possible for others coming after Plato to generate a natural astrology out of Plato's cosmology.

Plato, Giordano Bruno and blood circulation

Let us make a second, briefer visit to the Renaissance. Harvey is famous for establishing that the blood circulated around the body, but others had speculated on this before him. While Harvey's influences were Aristotelian, others worked in the Renaissance neoplatonism tradition. Giordano Bruno speculated on the circulation but unlike Harvey did not follow this up with skilled dissection and experiment. However, he does say that:

The blood and other humours are in continuous and most rapid circulation.⁷³

So too we are told that the blood from the heart:

Goes out to the whole of the body and comes back from the latter to the heart, as from the centre to the circumference and from the circumference to the centre, proceeding so as to make a sphere.⁷⁴

Furthermore we are told of:

The blood which in the animal body moves in a circle.⁷⁵

In *De Immenso et Innumerabilibus*, Bruno also tells us that:

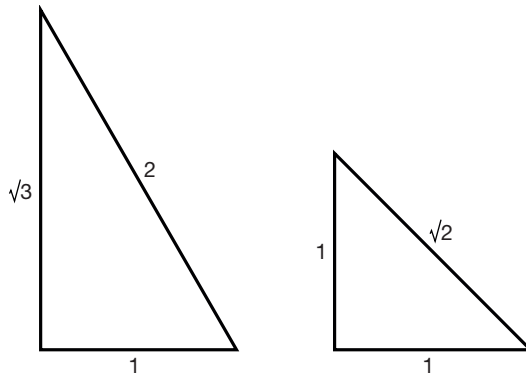
In our bodies, the blood and other humours in virtue of spirit run around and run back, as with the whole world, with stars and with the earth.⁷⁶

Bruno quite specifically asks why the blood moves continually in this manner.⁷⁷ His answer comes by way of a macrocosm/microcosm analogy. What explains the ebb and flow of tides, winds, rain, springs coming from and going into the earth?⁷⁸ According

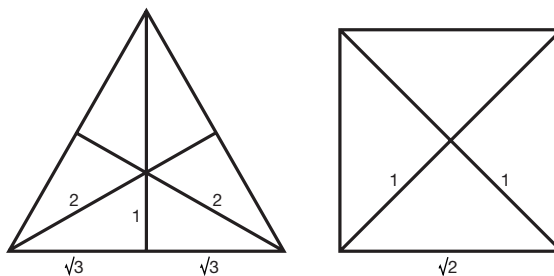
to Bruno, who rejects several other answers as unsatisfactory,⁷⁹ it is what Plato called soul and is defined as the number which moves itself in a circle.⁸⁰ Similarly with the human body, it is the natural circular motion of soul which is the reason for the circulation of the blood. In *De Monade, Numero et Figura*, Bruno is keen to emphasise the heart as centre of the microcosm, from which the vital spirits go out to the whole of the body.⁸¹ There is little doubt that Bruno goes beyond what Plato says. Plato does not specifically mention the circulation of the blood or the speed of its circulation, and it would be hard to extract such ideas from the *Timaeus*, even though many of the ingredients are there.⁸² Again though we see how the Renaissance natural magic tradition builds on Aristotle and Plato.

Plato and alchemy

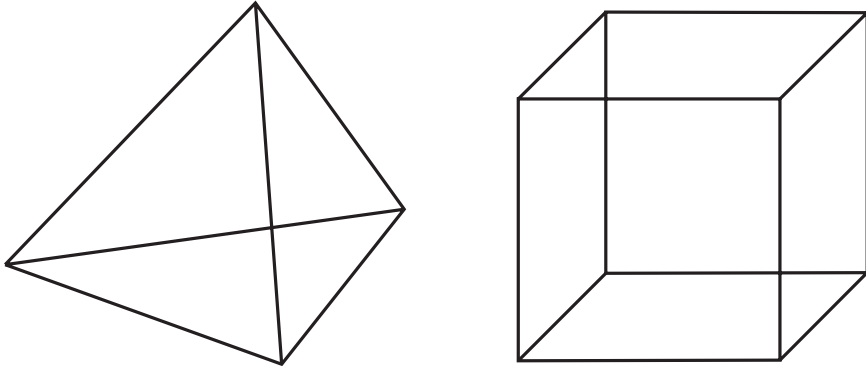
Transmutation of the elements is a straightforward and natural process for Plato. The only oddity is that while water, air and fire can transmute into each other, none of these can transmute into earth and earth cannot transmute into other elements. At the root of Plato's theory are two basic triangles:



These basic triangles form up into complexes of triangles in the following ways:



These squares then form up into cubes of earth, while the triangles can form up as tetrahedra of fire, octahedra of air or ikosahedra of water.



It is readily apparent that three dimensional figures for fire, water and air can dissociate back into their complex triangles which can then form up again as a different element and that the triangles and squares which go to make up earth are incompatible in this sense with the components of the other three elements. Change between the three elements capable of changing into one another is an entirely natural process for Plato. There were alchemists who took up this theory of matter, though it was far less popular in this respect than the Aristotelian theory.

Conclusion

In Aristotle, we can find an entirely natural basis for ancient astrology, ancient alchemy and the macrocosm/microcosm relationship. As I emphasised at the beginning of this chapter, this is not to say that Aristotle was an astrologer or an alchemist in any sense, merely that a natural basis for these disciplines was possible. So we cannot move from 'x believed in astrology, alchemy or the macrocosm/microcosm relationship' to 'x believed in something non-natural'. Aristotle also has an entirely natural explanation of dreams and prophecies arising from dreams. Aristotle also had an entirely natural conception of god. His god is invariant, has its own nature and does not intervene in the world. It is significant that Aristotle is in close temporal proximity to the presocratics. It is also significant that Aristotle's views formed the basis of a great deal of natural magic thinking in the Renaissance. A natural belief in disciplines which are often thought magical or non-natural was perfectly possible at the time. In Plato too we can find an entirely natural basis for ancient astrology, ancient alchemy and the macrocosm/microcosm relationship, without Plato being an astrologer or alchemist. That is important for the same reasons it is important in Aristotle. Whether Plato believed everything to be entirely natural is an extremely complex question which I do not intend to go into in depth here, as it depends on definitions of natural/non-natural and interpretations of some highly contested areas of Plato.⁸³ What I want to take

away from this chapter is that ancient astrology, ancient alchemy and macrocosm/microcosm relationships could be, and in some cases were, entirely natural. If one likes the terminology, they were rational. When we look at the presocratics we need to bear in mind these possibilities for what we might term 'magical' disciplines.

The Milesian Philosophers

In this chapter on the Milesians, I am going to take them out of chronological order and deal with Anaximander first. This is because with Anaximander it is slightly easier and clearer to set up key issues. I will start by setting out the case that Anaximander's view of the world is an entirely naturalist one. One important issue here will be his explanation of meteorological phenomena, which I will argue is not only natural, but specifically targets non-natural explanations of these phenomena in Hesiod. I will also argue that the extant fragment of Anaximander indicates a lawlike world and that he has an interesting, empirically backed account of the origins of life. The case against Anaximander is that he is alleged to have used the term 'divine' to describe the *apeiron*, the unlimited. Whether that matters is another issue and I will argue that Anaximander's position is a type of pantheism. The discussions of Thales, Anaximenes and the later Anaximenes-influenced Diogenes of Apollonia will take largely the same format, a case for the view that they explained the world in an entirely natural way and a case against.

Anaximander: meteorology

A key piece of evidence that Anaximander rejected non-natural explanations in favour of natural explanations is that:

Concerning thunder, lightning, thunderbolts, hurricanes and typhoons. Anaximander states that all these come about because of wind. Whenever it is enclosed in a thick cloud and then forcibly breaks out, due to its fineness and lightness, then the bursting makes the noise, and the rent against the blackness of the cloud is the lightning flash.¹

We find something similar in Seneca:

Anaximander explained everything in terms of wind. Thunder, he said, was the sound of smitten cloud. Why is there inequality? Because the blows themselves are unequal. Why is there thunder in a cloudless sky? Because even then air jumps

through the thick and cut atmosphere. Why sometimes is there lightning but not thunder? Because the air is weak, not strong enough to support flame, but strong enough to support sound. What is the actual lightning flash? Disturbance generated by air dissipating and rushing together again, producing weak air which cannot escape. What is a lightning bolt? The rapid motion of more active, denser air.²

And so too in Hippolytus:

Winds happen when the lightest vapours of the air are separated off and gathering together are set in motion. Rain is due to the vapour which comes up from things under the sun. Lightning happens when wind escapes by breaching clouds.³

Pseudo-Plutarch also tells us that:

Anaximander believed wind to be flowing air, the finest and moistest parts of it being set in motion and melted by the sun.⁴

What is often said about the lead passage here is that thunder (*brontê*), lightning (*astrapê*), thunderbolts (*keraunos*), hurricanes (*prêstêr*) and typhoons (*tuphos*) are all phenomena which the Greeks of the time considered to be caused by the intervention of the gods. Vlastos comments that:

Lightning, thunder, a storm, an earthquake were 'signs from Zeus' that could stop a meeting of the Law Courts or of the Assembly;⁵ religious feeling for an eclipse could overrule military intelligence to cause the greatest disaster ever suffered by Athenian arms.⁶

It has also been said that it is significant that Anaximander, and those who follow him, gave a natural explanation for classes of phenomena (all instances of thunder) where Homer and Hesiod focused on single instances of these phenomena.⁷ Thunder, lightning and thunderbolts are all quite straightforward. The difference between lightning and thunderbolt is roughly that between the modern terms 'sheet lightning' or 'cloud to cloud' lightning and 'cloud to ground' lightning. I have translated *prêstêr* as 'hurricane' but it can also mean 'waterspout attended with lightning' according to LSJ. In some contexts this latter sense is evident in that the *prêstêr* is said to have emerged from the sea. *Tuphos* is usually translated typhoon though it can mean whirlwind as well. As we shall see in a moment, winds are associated with the god *Tuphos* in Hesiod. I will refer to these five meteorological phenomena as the 'Anaximander phenomena' as their natural explanation will be a recurrent theme among the presocratics. By rejecting such explanations for these phenomena in terms of the gods and providing natural explanations instead we see a general rejection of non-natural explanation in favour of natural explanation.

A more sceptical view here is that while this may be an interesting fragment about meteorology, can we really take this as conclusive evidence of a conscious, intentional rejection of the non-natural in favour of the natural?⁸ It is possible to highlight fragments like these which appear to favour natural explanation, but either for Anaximander individually or the presocratics collectively if we feed in

other fragments the idea of natural explanation looks much less clear or collapses completely. Taken on its own this fragment may seem to give natural explanations but they may be accidental and it is after all one fragment and very far from the whole picture.

In reply to this, I want to begin an argument which will run through this book. This is that we find a comprehensive, consistent and targeted rejection of non-natural explanations. Comprehensive in that we find a great number of natural explanations of phenomena that had previously been explained in term of non-natural intervention. Consistent in that there are basic principles within each thinker used to explain the phenomena rather than ad hoc explanations. They were targeted in three senses. Targeted on what was commonly attributed to intervention by the gods. Targeted on most important cases and hardest cases to demonstrate natural explanation. Targeted in particular on Homer and Hesiod, both in terms of their general views and in terms of famous passages. In particular the targeting thesis here, if it can be substantiated, entails that there was a conscious and systematic rejection of non-natural explanation in favour of natural explanation.⁹ This also gives us what Lloyd has termed a 'context of polemic'.¹⁰ The presocratics do not give their natural explanations *in vacuo*, but as part of a polemic.¹¹ If the targeting thesis is correct though, the presocratics do not target non-natural beliefs as part of some other polemic, the attack on non-natural beliefs is the polemic.

Here I argue that Anaximander is targeting Homer and in particular Hesiod in his rejection of non-natural explanation for meteorological phenomena. Later in this chapter I will argue that Anaximander is comprehensive, consistent and deals with important cases of other phenomena which were commonly attributed to the intervention of the gods, such as the origins of the cosmos, life, eclipses and earthquakes and provides a general picture for understanding the orderly behaviour of the cosmos. I think we can say something much more positive than 'these are the sorts of phenomena attributed to interventionist gods'. These are precisely the phenomena which Homer and Hesiod attribute to the intervention of the gods and to Zeus in particular. In Homer, there is a common association of the thunder and thunderbolt of Zeus,¹² as well as the thunder and lightning of Zeus.¹³ In the *Odyssey* there is a recurring motif of a ship being hit by the thunderbolt of Zeus.¹⁴ Early on in Hesiod's *Theogony* we find that:

She bore the proud-hearted Cyclops, Thunderer, Lightninger and Vivid Lightning, who gave Zeus his thunder and forged his thunderbolt.¹⁵

When Zeus enters the battle against the Titans:

From heaven and Olympus he came with lightning and thunderbolts flew from his hand amid thunder and lightning, trailing sacred (*hierên*) flame.¹⁶

There are many similar passages in the *theogony* where Zeus is associated with thunder, lightning and the thunderbolt.¹⁷ If we want a passage with all five of the terms that Anaximander mentions, then we need look no further than the tale of Zeus against the Titans in the *Theogony*. In lines 845 and 846 we get thunder, lightning, hurricane and thunderbolt. Zeus then uses his weapons of thunder, lightning and

thunderbolt to defeat Typhoeus, who produces strong winds and wet winds.¹⁸ It is notable that the same creature is described as lawless (*anomon*) earlier on,¹⁹ and that as Zeus descends he is trailing a sacred (*hierên*) flame.²⁰ *hieros* will also be used to describe the sacred disease of epilepsy in the Hippocratic corpus. This passage is significant in that this looks like a targeting not just of the general views of Homer and Hesiod but of a specific passage and what would have been a famous and well-known passage to the presocratic Greeks. We should also note in relation to the Hippolytus passage we looked at which gave natural explanations for wind and rain, that Zeus as the cloud-gatherer is a standard epithet in Hesiod and in the *Iliad* and *Odyssey*,²¹ Zeus also produces rain²² and generates storms.²³ That winds are caused by the gods is again standard in Homer and Hesiod.²⁴

Anaximander or later source?

It is worth looking a little more closely at the nature of the passage we began this chapter with, on thunder, lightning, thunderbolts, hurricanes and typhoons. This passage can be found in two ancient sources, Stobaeus and Pseudo-Plutarch, both of whom are generally thought to be summarising an earlier and longer source, Aetius. There are some minor differences in wording between Stobaeus and Pseudo-Plutarch but nothing to suggest they had independent sources.²⁵ It is important to recognise here that the first sentence in our passage is in fact a section heading in both Stobaeus and Pseudo-Plutarch. So 'Concerning thunder, lightning, thunderbolts, hurricanes and typhoons' stands away from the rest of the text and then Stobaeus and Pseudo-Plutarch give first the views of Anaximander then the views of many other thinkers. The passage is sometimes presented with the heading incorporated into the passage, which can give a stronger impression that the meteorological phenomena referred to are Anaximander's own category. Is this a doxographer's category or is it Anaximander's? Did a previous doxographer, then followed by Pseudo-Plutarch and Stobaeus, generate the category of 'on thunder, lightning, thunderbolts, hurricanes and typhoons' and then gather together the scattered remarks of the philosophers on this issue and place them in this category? Or did Anaximander generate this as a specific topic which later thinkers also treated as a specific topic? If the latter that is important as it sets an agenda and it may not be only Anaximander who targets the passages in Homer and Hesiod in this respect.

In favour of the latter view is that this is an odd collection of phenomena for a doxographer to bring together in one heading, especially as typical headings in Pseudo-Plutarch and Stobaeus are quite simple and brief. How likely is it that precisely those five phenomena were grouped together by a doxographer in relation to Anaximander grouping them together because they are part of a famous passage in Hesiod? It is notable that Anaximander is named first, as Pseudo-Plutarch and Stobaeus are by no means strictly chronological in arranging their doxography. It is also important that Anaximander believes all these phenomena are explained by air so that this group clearly has a coherence for Anaximander. Anaximander may target

Homer and Theognis as well, so that this is not an isolated example. Both Aristotle and Hippolytus report that Anaximander's *apeiron* was 'immortal and unaging'.²⁶ This is a formula which Homer uses to describe the gods.²⁷ So the attributes of the gods are passed to Anaximander's *apeiron*. Such a formula would be easily recognised in a culture of oral transmission and Anaximander's use of it in very different circumstances would have been evident.

Stobaeus, who is the fuller source, mentions Metrodorus, Archelaus, Xenophanes, Diogenes, Empedocles, Leucippus as having views on some of these phenomena. He has Anaximenes, and Anaxagoras as having views on all five, along with Aristotle, Chrysippus and Strato. Democritus is reported on four of these phenomena, but not on typhoons and Heraclitus on three, again lacking typhoons and slightly oddly thunderbolts as we know that Heraclitus did mention them.²⁸ Both Democritus and Heraclitus deal with winds though and as the passage in Hesiod has Typhoeus a god of winds that may be enough for all five. It is also worth noting in relation to the chronology here that Epicurus deals with these four phenomena plus winds in a close sequence,²⁹ as does Lucretius who opens book six of *On the Nature of Things* with a set of natural explanations of meteorological phenomena.

There is a further consideration here though which is that Aristotle in his *Meteorology* also groups together thunder, lightning, thunderbolts, hurricanes and typhoons.³⁰ The first paragraph of chapter two book nine is:

Let us speak of lightning and thunder, and then typhoons, hurricanes and thunderbolts. The same basic principle applies to all of them.³¹

In book one chapter one of the *Meteorology* Aristotle says that the phenomena he will look at all occur according to nature (*kata phusin*) and he groups together thunderbolts, typhoons and hurricanes as something he wishes to pay attention to. Aristotle actually deals with thunder and lightning in *Meteorology* II/9 and with thunderbolts, typhoons and hurricanes in *Meteorology* III/1. As Pseudo-Plutarch and Stobaeus, following Aetius, all use this section heading and use other section headings from the *Meteorology*, could it be that Aristotle initiates this category and the later doxographers then include assorted views of the presocratics in it? This would seem an odd category for Aristotle to come up with though and again this is significantly longer and more diverse than other section headings for the *Meteorologica*. These five phenomena do not make up some natural kind for Aristotle nor are they exhaustive of a particular type of meteorological phenomenon or a particular type of explanation for him. While 'The same principle applies to all of them', Aristotle uses his theory of wet and dry exhalations to explain many other phenomena. It is at least equally likely that Anaximander originated this category and it was passed through the presocratic philosophers down to Aristotle. It is also notable that neither Pseudo-Plutarch nor Stobaeus treat the view of Aristotle any differently to other philosophers here. There is no sense that Aristotle originated this category and his views are simply reported in chronological sequence, after those of the presocratics and before those of Chrysippus and Strato.

We cannot rule out the possibility that the category of 'Concerning thunder, lightning, thunderbolts, hurricanes and typhoons' was a later construction and then doxographers fitted some disconnected view of Anaximander into that category.

On the balance of the evidence though I believe that Anaximander originated this category and that he did so in direct criticism of the passage in Hesiod we have looked at. If that is so, it has an important consequence. We have a good deal of material from the doxographers attributing natural explanations to presocratic thinkers. Lloyd has questioned the extent to which that reflects the interests of the doxographers or the interests of the presocratics.³² This example would suggest that at least some of that material emanates from the interests of the presocratics.³³

The Anaximander fragment

Let us now consider Anaximander at a more philosophical level. Simplicius tells us that:

Anaximander, son of Praxiades of Miletus, was a follower and student of Thales. He said that the arche and element of existing things was the unlimited, being the first to give this name to the *archê*. He says this is not water, nor any of the other so-called elements, but some other unlimited nature, from which are generated all the heavens and the cosmos in them. The source of generation for extant things is that into which destruction occurs.³⁴

I don't propose to go into this in any philosophical detail, I want just to point out that all that exists for Anaximander comes out of the *apeiron* and will ultimately be destroyed back into the *apeiron*. If we take this as exhaustive of what there is, and there is no indication that we should not, then there is nothing non-natural for Anaximander. In particular, in relation to the idea of extended world I mentioned in the introductory chapter, Anaximander does not see himself living in an extended reality with anything non-natural to participate in. Simplicius gives us Theophrastus' summary of Anaximander's views:

Of those who say it is one, in motion and unlimited (*apeiron*),³⁵ Anaximander, son of Praxiades of Miletus, was a follower and student of Thales. He said that the arche and element of existing things was the unlimited, being the first to give this name to the *archê*. He says this is not water, nor any of the other so-called elements, but some other unlimited nature, from which are generated all the heavens and the cosmos in them. The source of generation for extant things is that into which destruction occurs, **according to necessity. They pay penalty and retribution to each other for injustices according to the order of time**, as he says in a poetic fashion.³⁶

The words in bold here are generally accepted as Anaximander's own.³⁷ This confirms that the *apeiron* and what comes from the *apeiron* is exhaustive of what is, if the *apeiron* is unlimited. The exact nature of what Anaximander meant 'in a poetic fashion' has been the matter of considerable debate. What has not been in debate is that it asserts lawlike, invariant behaviour. This passage too may be significant in relation to the poets. Theognis, a sixth century BCE poet, wrote:

They seize property by violence; kosmos has perished
Equitable distribution no longer obtains.³⁸

Against this decline in moral standards, we might see Anaximander asserting that there can be no such decline in the behaviour of the cosmos. The word in the fragment which is usually translated as 'necessity', *chreôn*, also has a sense of what is right or proper, and what ought to be done.³⁹ This gives a stronger moral sense to the regularities of the cosmos for Anaximander.

Anaximander and zoogony

Anaximander gives the first extant natural theory of the origins of life. Clearly this is both important for a comprehensive natural explanation of the world and also a hard case in that this might be thought difficult to explain in natural terms. It may also target previous theories where the intervention of the gods was thought to be necessary for the generation of life. Pseudo-Plutarch gives the following account of Anaximander's zoogony:

Anaximander said that the first animals were generated in moisture and enclosing themselves in spine like barks, as they advanced in age they moved onto the drier and shedding their bark for a short time they survived in a different form.⁴⁰

I have argued elsewhere that this is a very good description of the life cycle of the Caddis fly.⁴¹ There were many species of Caddis Fly living in Greece in Anaximander's time and they are widespread throughout Europe today. They begin their life as eggs in freshwater, before becoming larvae. The larvae construct for themselves a case out of many different materials depending on species and what is to hand. Often used are small twigs, bark, vegetation, mollusc shell, gravel or sand. The cases are typically 25mm long and 5mm in diameter, and are held together with a secretion made by the larvae. The cases can be fairly smooth or quite rough in texture, they can be tubular, spiral or square and they can be straight or curved along their length. They are commonly but not always closed at one end and they can serve as camouflage and physical protection. The next stage is for the larvae to pupate, often attaching the case to the underside of a stone, and sealing up both ends. The pupae then break out of the cases, swim to the surface, shed their skin and fly off. They typically live for several months in the water, and typically live for between one and two weeks as flies.

Caddis fly larvae do not generate spontaneously from moisture, though it is quite possible Anaximander believed that they did. Aristotle believed that the larvae of many flying insects were produced spontaneously.⁴² Possibilities for observing supposed spontaneous generation were widespread in the ancient world, the instances most usually cited being the proliferation of flies arising from the drying mud of the Nile or the Tigris/Euphrates after the recession of floodwaters. The young larvae do enclose themselves in cases, and in fact may do this several times, shedding their cases as they grow too large and constructing new ones.

Why might Anaximander have chosen the Caddis fly? Here are some possible advantages of this theory. He gets the initial (and ongoing) generation of living things

from moisture. He might have chosen other flies but here is something indigenous to ancient Greece which comes from streams rather than any human generated water source and does not depend on any other animal for its generation. With this metamorphosis he gets an example of an apparently simple life form (the Caddis grub) transforming into an apparently much more complex life form (the Caddis fly), and doing so relatively swiftly.

If this theory is correct, then Anaximander's zoogony is rather more than the 'genial fantasy' Barnes describes it as.⁴³ It is a serious attempt to explain the origins of life by natural means, in a non-arbitrary manner, with observational support. As with Anaximander's cosmogony, his zoogony eschews ad hoc explanations in favour of law like ongoing processes. I would entirely disagree with Barnes who says that:

There is no suggestion that this mode of reproduction occurred more than once.⁴⁴

One important aspect of Milesian cosmogony was that the underlying processes which generate the cosmos are ongoing, unlike mythical or theogonical accounts.⁴⁵ The separating out and interchange of elements does not cease once the cosmos has been formed in Anaximander, nor does the condensation and rarefaction of elements in Anaximenes. There is of course progress in that the cosmos has been formed, but the basic processes remain in action. Even if we adopt the older view of this passage, which attributes the genesis of life in Anaximander to some form of primitive sea animals, we still have him addressing the key issue of the origin of life citing only natural entities.

Anaximander and the divine

The case against Anaximander giving entirely natural explanations for phenomena is based on the following passage from Aristotle:

The unlimited has no *archê* ... However, this seems to be the *archê* of all other things, and it surrounds and steers all, as with all those who do not suppose other explanations, such as mind or love, beyond the unlimited. This is divine, for it is immortal and unaging, as Anaximander and most of the physiologists say.⁴⁶

Anaximander is then supposed to have believed in something divine and therefore something non-natural. Let us look a little more closely at the passage though. Does Aristotle say that Anaximander believed this to be divine, or that it is divine because it is immortal and unaging?⁴⁷ It would be no great surprise if Aristotle moved from 'immortal and unaging' to saying 'divine' even if Anaximander did not himself say so. Aristotle thinks of the heavens in his own philosophy as divine, even though they only do what is entirely natural for them to do. Aristotle's god does only what is entirely natural to it, while not actively affecting any other part of nature. Aristotle discusses what occurs according to nature (*kata phusin*) and what occurs contrary to nature (*para phusin*).⁴⁸ Aristotle has something very specific in mind here though. What occurs contrary to nature is a matter of chance. The idea that there is something

outside of nature or that the non-natural can override the natural is entirely alien to Aristotle's thought.⁴⁹ So if this is Aristotle's attribution of the divine to Anaximander, there is nothing to be concerned about here.

Another aspect of this passage is that Aristotle says most of the physiologoi say that their *archê* is immortal and unaging. Did Anaximander start a tradition here based in a targeted reference to Homer that the basic material principles for the physiologoi are immortal and unaging? There are two senses here, the weaker being that Anaximander started a tradition and other physiologoi had immortal and unaging material principles, the stronger being that they actually used the 'immortal and unaging' phrase to describe them, even if that is now lost from the fragments.

Should we be worried if Anaximander did indeed consider the *apeiron* to be divine?⁵⁰ Returning to our discussion of the nature of the non-natural in the discussion, we can consider something non-natural if it is outside or beyond nature, or if it is not bound by natural laws. The first alternative here is easily dealt with as clearly the *apeiron* is not outside of nature. That the Milesians advocated some form of pantheism though is now widely accepted.⁵¹ As for the second alternative, I emphasised in the last section that for Anaximander everything occurs according to natural law. It matters little then if Anaximander did describe the *apeiron* as divine. It is part of nature and obeys natural laws so there is nothing non-natural about it.

The unlimited would seem to have some power to steer. This is a translation of *kubernan*, which means simply to steer, as in to steer a boat, or more metaphorically, to guide or govern.⁵² Furley has suggested that the steering may occur once and once only, setting the *cosmos* on a course which it then follows.⁵³ Although that is a possibility, I see no evidence to support it. In the Aristotle passage, the unlimited presumably surrounds the *cosmos* at all time rather than just at an initial moment, but no distinction is drawn between surrounding and steering in this respect. Nor do any of the other passages concerning steering suggest that this is a one-off, rather than a persistent factor in the *cosmos*. Plato famously criticised Anaxagoras for postulating a cosmic intelligence which withdraws after initially ordering the *cosmos*. Had any of the Milesians had a similar theory, we might expect to see similar criticism of it somewhere in Plato. It is interesting that Plato does ask:

Should we say that the whole universe is ruled by unreason, irregularity and chance, or on the contrary, as some of those who came before us said, say that *nous* and a marvellous organising intelligence steer (*diakubernan*) it.⁵⁴

This is interesting not only for the attribution of a steering principle, but also in that Plato perceives a sharp bifurcation of explanation by 'unreason, irregularity and chance' and explanation in terms of a steering principle. Slightly later in the *Philebus*, he says that:

This supports those of old who believed that *nous* always rules the universe.⁵⁵

This is significant in that it cannot be Anaxagoras that Plato is referring to here. Plato is critical of Anaxagoras for allowing *nous* to withdraw from the *cosmos*, while these men of old have *nous* always ruling the *cosmos*.

Anaximander is not alone in supposing some form of steering principle. Heraclitus,⁵⁶ Parmenides,⁵⁷ the Hippocratics⁵⁸ and Diogenes of Apollonia⁵⁹ all make

use of a steering function,⁶⁰ and below I will argue that Anaximenes does as well, in addition to Thales. It is unclear on the available evidence what the precise nature of the steering function is or what it steers for. A reasonable supposition though would be that it steers the separation process so that a *cosmos* rather than a chaos is formed out of the unlimited.

To return to a question I asked in the introduction. Did Greek philosophers, using their own conception of god and their own criteria for natural/non-natural, to their own satisfaction show that there could be a belief in god without a belief in the non-natural? There I said that the answer to that, in many cases, is yes. I would certainly say that is the case for Anaximander. So I would disagree with West when he says that:

Anaximander for his part was no vigorous rationalist.⁶¹

Nor do I agree that 'it is more meaningful to classify as "theological" language such as "They pay penalty and retribution to each other for injustices according to the assessment of time"' which Anaximander uses in describing change.⁶² There is also the famous comment by Jaeger that:

What happens in Anaximander's argument (and that of his successors in line) is that the predicate God, or rather the Divine, is transformed from the traditional deities to the first principle of Being (at which they arrived by rational investigations), on the ground that the predicates usually attributed to the gods of Homer and Hesiod are inherent in that principle to a higher degree or can be assigned to it with greater certainty.⁶³

The predicates that Jaeger refers to are ungenerated, incorruptible, undying, indestructible.

There are several different forms of pantheism. Some differ in the nature of the identity relation between god and nature. Most common is the view that god and nature are identical and exhaust what is, which would seem to be Anaximander's view.⁶⁴ The identity is usually material (the matter of the world is also god) but may be ideal (nature is a manifestation of god) and Anaximander would be in the former group here.⁶⁵ I would also note that Anaximander's pantheism, as far as we have evidence, seems to come from argument rather than religious experience. There is a distinction in modern pantheism between theistic and atheistic pantheism, depending on what emphasis is given to god and nature. So to say that God is nature would be to come down on the theistic side of this distinction, to say that nature is divine would be to come down on the atheistic side. While recognising that as a modern rather than an ancient distinction, it would seem that from Aristotle's evidence that Anaximander would come down on the atheist side of this divide (the *apeiron* is immortal and unaging and so is divine). I make these points for the sake of clarity, not to argue a line on secularism. As we will see in the chapters on the Hippocratics, I believe the presocratic pantheists have an important critique of atheism.

Anaximander and numerology?

There is a question which I will introduce here but postpone a deeper discussion of until later. This involves Anaximander's use of number in his description of the proportions of the cosmos. Hippolytus tells us that for Anaximander:

The circle of the sun is 27 times that of the earth and moon 18 times.⁶⁶

Why these numbers? As many commentators have pointed out, this is not something that Anaximander could have arrived at by observation or experiment. Various explanations have been offered without anything really convincing standing out. Kahn has suggested comparisons with the three steps of Vishnu in Indian thought, where 3 has a symbolism, not least of beginning, middle and end and is also important for the unity of the world.⁶⁷ Anaximander then has three as the common denominator for his proportions. Kahn though stresses that it is more appropriate to speak of:

A rational element in Vedic thought than of a mythic element in Milesian cosmology.⁶⁸

Hahn has suggested links to architecture and some types of geometrical calculation used there.⁶⁹ West has suggested that Anaximander is here drawing on some mythic or poetic materials from outside the Greek tradition.⁷⁰ I will state a view here which I will defend in more detail in the chapter on the Pythagoreans and numerology. There were many forms of numerology and many of those did not entail any non-natural belief. Between the modern conception of how mathematics relates to the world and early number superstition, there were many interesting forms of numerology. So even if we take Anaximander to be employing some form of numerology here, we cannot infer that he had any non-natural belief without a great deal more argument and evidence.

Anaximander and the Spartan earthquake

Two important issues for natural explanation are earthquakes and divination. Thales and Anaximenes have natural explanations of earthquakes and divination is an important topic for Aristotle and some presocratics. It is interesting then that Cicero tell us:

Many things are foreseen by doctors, steersmen, and so too by farmers, but I do not call these divination, not even, in fact, when Anaximander, the natural philosopher (*physico*), warned the Spartans to leave their city and to sleep in the fields with their arms, because an earthquake was near. The entire city fell down and the mountain edge of Mount Taygetus was ripped away like the stern part of a ship when in a storm.⁷¹

So Anaximander the natural philosopher's prediction of the earthquake was not an act of divination. We do not know how Anaximander predicted the earthquake, though it is possible he had some folk knowledge about the behaviour of animals

prior to earthquakes. How reliable this passage is and what its precise import is are both debatable, though we do have independent evidence that Anaximander went to Sparta.⁷² The primary reading though would seem to be that Anaximander could predict earthquakes naturally and did not practise divination.

Anaximander and eclipses

Eclipses were seen as portents by the early Greeks as is evidenced by the famous occasion when the departure of an army was delayed due to an eclipse. Thucydides says that:

The preparations were made and they were on the point of sailing, when the moon, being just then at the full, was eclipsed. The mass of the army was greatly moved, and called upon the generals to remain. Nicias himself, who was too much under the influence of divination and such like, refused even to discuss the question of their removal until they had remained thrice nine days, as the soothsayers prescribed.⁷³

Herodotus also gives us an interesting passage:

When it had just set forth, the Sun left his place in the heaven and was invisible, though there was no gathering of clouds and the sky was perfectly clear; and instead of day it became night. When Xerxes saw and perceived this, it became a matter of concern to him; and he asked the Magians what the appearance meant to portend. These declared that the god was foreshowing to the Hellenes a leaving of their cities, saying that the Sun was the foreshower of events for the Hellenes, but the Moon for the Persians. Having been thus informed, Xerxes proceeded on the march with very great joy.⁷⁴

The belief in eclipses as portents was then widespread, but it is also interesting, as Vlastos has pointed out, that here the sun 'left his place in the heaven.'⁷⁵ Here natural regularities are breached. It is not the case that some other body has come between the earth and the sun, but the sun has left the heavens and in doing so has breached the regularities of nature. One can point to similar passages in Pindar where the eclipse of the sun is seen as arbitrary with a sense that once this has happened, all manner of catastrophes may follow.⁷⁶

According to Anaximander though, eclipses are entirely natural phenomena. His account of the heavens may look a little odd, but is entirely natural. Anaximander believes there to be wheels which enclose fire. These wheels have small apertures in them and we see the enclosed fire. These are what we see as the heavenly bodies. The apertures periodically become occluded, which is his explanation of why eclipses occur. So Pseudo-Plutarch tells us that:

Concerning what the moon is.

Anaximander, it is a circle nineteen times that of the earth, like that of the sun, filled with fire. Eclipses occur with the turning of the wheel. This is like a hollow rim full of fire, having a single mouth.⁷⁷

He also says:

Concerning eclipses of the moon.

Anaximander, when the aperture on the wheel is obstructed.⁷⁸

Thus we see no portents, no sense of the regularities of nature being breached, no sense of impending catastrophe.

Anaximander, Homer and Hesiod

One might raise the following objection to contrasting Anaximander with Homer and Hesiod. Homer and Hesiod have gods who have wills. Anaximander has a god which steers all things. What is the difference between those views? Why can we really speak of the naturalism of Anaximander and contrast that with Homer and Hesiod?

To return to our discussion in the introduction of this book, the key issue is invariance. There is a distinction between the capricious, unpredictable nature of the gods of Homer and Hesiod and the regular manner in which the *apeiron* steers for Anaximander. There is a distinction between the way in which the gods of Homer and Hesiod can intervene in nature, breaching regularities, and the way in which the *apeiron* effectively underpins the regularity of nature for Anaximander.

Martin has quite rightly questioned whether the notion of intervention in nature is a modern one and is inappropriate for the ancient Greeks.⁷⁹ Certainly it is inappropriate for ancient Greek pantheism as god is not separate from nature and so can hardly intervene in it in the modern sense. I think there is a reasonable way though in which the gods of Homer and Hesiod can be said to intervene in nature. They are capable of breaching the regularities of nature where other entities are not. Explanation in terms of the gods in Homer and Hesiod is not just a question of 'there is lightning and we explain that as due to Zeus'. The gods, from their own caprice, actively create phenomena. So Zeus generates lightning to blast ships for his own purposes and the plague at the beginning of the *Iliad* is due to Agamemnon offending Zeus. In this sense they are capable of intervening in nature. A related point which I will develop in a later chapter is that while Greek prayer often called upon the gods to intervene, some presocratics developed prayers which focused on achieving a better mental state instead.

There is a tricky question of whether some presocratics believed there was a category of the non-natural. I would phrase things like this. I can imagine what it might be for something to be supernatural, but I do not think that there is anything which is supernatural. Some presocratics could imagine what it might be for something to be non-natural (the gods of Homer and Hesiod) but could believe those things do not exist.

Why did Anaximander reject the non-natural? Again, Martin has quite rightly raised this question for the Greeks in general as it is easy to assume that the Greeks rejected the non-natural for the same reasons we reject the supernatural.⁸⁰ Martin's view is that the Greeks did not reject the supernatural (they had no concept of it)

and had no reason to reject the supernatural.⁸¹ In my view, Anaximander rejects the non-natural because he adopts parsimony and invariance. Once he does that, as discussed in the introduction to this book, then considerations of parsimony will militate against supposing there is something more than nature while considerations of invariance will rule out anything that does not behave in a regular manner.⁸² Parsimony considerations here do not exclude the idea that the *apeiron* is divine and that it steers, as long as those aspects of the *apeiron* have an aetiological function. We will see some more of the aetiological function of pantheism with the Hippocratics.

Theory quality in Anaximander

There will be a running question for this book which is the quality of the theories put forward by the presocratics. Lloyd has commented, specifically for the Hippocratics but also for 'Presocratic natural philosophers'⁸³ more generally, that:

It was a mere act of faith – we might even say bluff – to claim to be able to explain, let alone control, the phenomena in question.⁸⁴

One might reply that the new natural theories are at least the right type of theories and that better explanations will follow. Lloyd's reply is that the way ahead for natural explanation was by no means clear and was hotly contested, both in terms of content and methodology.⁸⁵ I want to argue that there is more than an act of faith involved here and that presocratic natural theories had significant epistemological merit.⁸⁶

The motivation for the rejection of the non-natural, I suggest comes from deeper philosophical concerns. If one is committed to parsimony one would only want to hypothesise a non-natural explanation, with an ontological commitment to something beyond the natural, when all possible natural explanations had been exhausted and rejected. If one is committed to invariance one simply does not hypothesise the non-natural in the sense of non-invariant. In Anaximander we have a commitment to invariance from the extant fragment. One can argue that we have a commitment to parsimony either in terms of the nature of the *apeiron*, or in that Anaximander explains five meteorological phenomena in terms of wind alone. This then is an act of reason rather than faith. The focus may be as much on the rejection of non-natural ideas as non-viable as on what specific natural explanations could do. While Lloyd is correct to point out that the way ahead was unclear and contested, that is only so if we consider the presocratics as a group rather than as individuals.⁸⁷ To individuals, the way may have seemed clear.

What of the epistemological merits of Anaximander's theories?⁸⁸ As noted earlier, there is a certain coherence to Anaximander's views on meteorology. *All* of these phenomena are to be explained in terms of wind. This is a general theory of considerable scope. Is it a theory which leads to new predictions and explanations? Yes it is, we have concrete evidence for that in Anaximenes' extension of the theory. One could hardly expect a meteorological theory at this stage to be based on experimental evidence. Is Anaximander's theory based on observation? In the sense that

it is compatible with ordinary observations, yes. There are two places where the quality of Anaximander's theorising is under appreciated, his cosmogony and his zoogony. Anaximander makes the assumption that the processes which are fundamental to cosmogony and zoogony are still going on today. That is by no means a bad assumption and has been debated in various fields since the eighteenth century and gradualist/catastrophist debate in geology. It means that Anaximander has observational support for his cosmogony and zoogony. He sees the processes in cosmology and the processes in Greek rivers for Caddis flies. He models the origins of the cosmos and of life on these. Could we expect a great deal more in terms of theory quality and observation at this stage?⁸⁹

One important issue in relation to this matter can be put simply like this. By whose criteria ought we to consider Anaximander's theories to have been poor? Another question would be; at the outset of attempting to explain citing only natural entities, how good do you expect the explanations to be? A third and final query; relative to whose theories are those of Anaximander poor?

Anaximenes and naturalism

The case that Anaximenes believed everything to be natural and explained phenomena citing only natural entities is similar to that for Anaximander and Thales. There is no extended world for Anaximenes. Anaximenes believed that everything came from and could be destroyed back into a single, natural substance. Anaximenes believed this to be air. Simplicius gives us Theophrastus' summary of Anaximenes' views:

Anaximenes son of Eurystratus, of Miletus, a companion of Anaximander, says like him that the underlying nature is one and unlimited, though unlike him it is not undefined, as he says it is air. It differs in its nature by being more rare or more dense. Becoming rarer, fire is generated, becoming denser wind, then cloud and denser still water, then earth, then stones, other things being generated from these. He makes motion eternal, and change is generated in this way.⁹⁰

Change, and the cosmogonical process, was a matter of condensation and rarefaction of this air. Pseudo-Plutarch tells us that for Anaximenes:

All things are generated by a certain condensation of air, and again by its rarefaction. Motion has existed for all time. He says that when the air felts, firstly the earth is generated, entirely flat, and because of this, it rides on the air. So too sun, moon and the other stars have their origins in generation from earth. At any rate he declares the sun to be earth, as it acquires abundant heat by moving rapidly.⁹¹

We have some more information on the formation of the heavens as Hippolytus says that for Anaximenes:

The heavenly bodies were generated from earth through the moisture rising from it. When this is rarefied, fire is generated, and from fire raised to a height the heavenly bodies are constituted.⁹²

There are more passages on condensation and rarefaction and on cosmology which confirm the initial impression that the world is an entirely natural place for Anaximenes.⁹³

Anaximenes and meteorology

Stobaeus tells us something very interesting about Anaximenes in relation to Anaximander and his views on meteorological phenomena. In his section 'Concerning thunder, lightning, thunderbolts, hurricanes and typhoons' he tells us that:

Anaximenes said the same as Anaximander, adding what happens with the sea, which flashes when broken by oars.⁹⁴

This follows directly on his comments on Anaximander. I have argued that Anaximander was very specific in which meteorological phenomena he chose to emphasise could be explained by natural means. These were precisely the sort of phenomena that we find explained by the actions of the gods in Homer and Hesiod. Anaximenes gives the same sort of analysis but adds an interesting analogy, that the sea flashes when it is broken by oars, presumably in a similar manner to the way in which we see a lightning flash when a cloud is broken by escaping air. A similar theory (the sea being struck by a stick at night) is criticised by Aristotle in his *Meteorology*.⁹⁵ Aristotle also tells us that:

Anaximenes says that the earth is soaked and dries out and so breaks. It is shaken by the hills which break off and fall down. So earthquakes occur both in times of drought and severe rain. In droughts, as has been said, it dries and cracks, and being made too wet by water it falls apart.⁹⁶

Previously the standard explanation of earthquakes was the intervention of Poseidon, who was standardly referred to as earth-shaker by both Homer and Hesiod.⁹⁷ As we saw with Anaximander, Zeus is often referred to as the cloud-gatherer and various types of weather are attributed to the intervention of the gods in both Homer and Hesiod. Stobaeus tells us that:

Anaximenes believed that clouds are formed from air through being highly thickened, and rain is squeezed out when they are compressed more. Snow occurs when rain falls down and solidifies, hail when air is gathered together with water.⁹⁸

Seneca also tells us that:

As Anaximenes says, air falling on clouds produces thunder and as it struggles to get through the obstructions tears them, it ignites as fire in its escape.⁹⁹

So Anaximenes had an entirely natural account of the formation of clouds and of how various types of weather occur. He also has an account of thunder and lightning. In both Homer and Hesiod Iris is standardly the goddess of the rainbow and messenger of the gods. In Homer, Zeus uses the rainbow as a portent for humans.¹⁰⁰ Pseudo-Plutarch tells us that:

Anaximenes believed the rainbow to be formed by the rays of the sun flashing on compacted, thick, black clouds and the rays being unable to cut through this mass.¹⁰¹

As with Anaximander, I argue that Anaximenes knew precisely what he was doing in rejecting certain types of explanations. Like Anaximander, his views are consistent, coherent and well targeted.

Against Anaximenes

Against the view that everything is natural for Anaximenes is evidence that he treated the cosmos as having a soul. Stobaeus tells us that:

Anaximenes declared air to be the *archê* of existing things. From it all things come to be and into it all things are dissolved. He says **as our soul, being air, holds us in order (*sungratei*), so wind and air envelop the whole *cosmos***.¹⁰²

The words in bold here are often held to be Anaximenes' own words, or at least to be a paraphrase of something that Anaximenes said though it is possible it continues the first sentence in reporting what the author believed were Anaximenes' views. There are worries here that the passage is not in the Ionic dialect Anaximenes would have used and that the 'He says' formula in these situations does not always guarantee a direct quote. One might also be concerned about the use of the words *cosmos* and *pneuma* (for air) so early in presocratic thought, though there are parallels for both at this stage among medical writers and the Pythagoreans.¹⁰³ Kirk, Raven and Schofield have argued that, *sungratei* is not found until much later Koine Greek.¹⁰⁴ According to them *sungratein* 'is really a compendium for *sunechein kai kratein*',¹⁰⁵ and that could only have come about much later. However, it may be close to a quotation and may well preserve the essential meaning of what Anaximenes had to say. There are two possibilities here. First, this is virtually a direct quotation, but it is rendered or paraphrased into a later dialect and where Anaximenes wrote *sunechein kai kratein*, Stobaeus writes *sungratein*. Alternatively, this may be Stobaeus' report on what he thought Anaximenes meant, and *sungratein* expresses what the commentator thought he meant. Attested uses of *sungratein* indicate that it means to keep troops together or to hold in, keep under control.¹⁰⁶

This passage can be seen as advocating a steering principle similar to that of Anaximander.¹⁰⁷ The evidence from Aristotle was that Anaximander's *apeiron*:

Embraces everything and steers all, as those say who do not suppose other explanations, such as mind or love, beyond the unlimited. This is divine, for it is immortal and indestructible, as Anaximander and most of the physiologi say.¹⁰⁸

Anaximenes must be a prime candidate, among those who do not suppose explanations such as mind or love beyond the unlimited. He does suppose air to be unlimited.¹⁰⁹ Diogenes of Apollonia, a follower of Anaximenes definitely held that air steers:¹¹⁰

That which has intelligence is called air by men, and all men are steered (*kubernasthia*) by this and it has a power (*kratein*) over all things. This seems to be a God to me and to have permeated everywhere, to arrange all things and to be in all things.¹¹¹

Here we have the direct statement that air steers, and also that air is intelligent. Second, air has power over all things. As the verb here is *kratein*, if Anaximenes had written *kratein* in similar circumstances one can see how a later summariser might have written *sungkratein*.¹¹² Finally, *diatithenai* means to arrange in proper place, or to manage well. This is significant as it links our steering principle to cosmogony, the process of arranging everything in the first place. It also links it to continuing to have it well arranged.

The objections to this being a fully natural account can be dealt with in much the same way as those with Anaximander. There is nothing here which is separate from nature. There is nothing here which acts in a variable manner. There may be a macrocosm/microcosm analogy between the body and the cosmos but there is no suggestion of causality between macrocosm and microcosm. There is a structural correspondence but no causality. The correspondence is of course no coincidence because that is the way that the universe has been steered, but it has been steered in an invariant manner.

Anaximenes and the divine

The second part of the case against Anaximenes is that he believed that air was in some way divine. Stobaeus tells us that:

Anaximenes says that air is god. It is necessary to understand with such accounts the powers which permeate the elements or the bodies.¹¹³

As for Anaximenes everything is air, then everything is god so it is hardly surprising that air/god permeates all elements and bodies. Augustine says of Anaximander and the gods that:

He did not believe that they made air, rather that they were made out of air.¹¹⁴

This may be a little garbled, but the essential point that gods are air is clear enough. The key points here are going to be like those for Anaximander. Anaximenes may call air divine or consider it to be a god, but he does not suppose there to be anything which is separate from nature nor does he suppose that there is anything which does not act in an invariant manner.

Diogenes of Apollonia

Diogenes of Apollonia, who wrote around 440–423 BCE,¹¹⁵ was essentially a follower of Anaximenes so we can deal with him here. Diogenes also favours air as the key substance and Simplicius tells us that:

Diogenes of Apollonia, almost the youngest of those who were concerned with these matters, for the most part wrote eclectically, on some issues following Anaxagoras, on others Leucippus. He says that the nature of the universe is air, infinite and eternal, out of which the forms of all other things are generated by rarefaction, condensation and change of state.¹¹⁶

Air for Diogenes is intelligent and steers, as we have seen previously in relation to Anaximenes and the other Milesians. This intelligence is the basis of the world order, according to Diogenes:

It would not be possible, he says, without *nous*, for it (the underlying substance) to be so divided that it has a share of everything, winter, summer, night, day, rain, winds and good weather. Other things as well, if one wishes to think of them, will be found to be in the best possible disposition.¹¹⁷

As we have seen, Diogenes of Apollonia, certainly holds that air steers.¹¹⁸ The same sort of comments are going to apply here as to Anaximenes. That air is considered to be a god, or to be intelligent is unproblematic. This god is not considered to be outside of nature and it acts in an invariant manner. Diogenes may not have been the most original of ancient thinkers, but he is a useful example for us and the way he links the steering terms together is significant.

Thales

The positive case for Thales firstly lies in the reports of the relevant general philosophical principles, which give a framework for natural explanation. Aristotle tells us that:

Most of the first philosophers thought of matter as the only principle of all things. That from which all things are, that from which a thing first comes to be, and into which it is ultimately destroyed, the substance persisting but changing in its qualities. This they say is the element and principle of the things that are and because of this they say there is no absolute coming to be or destruction, but its nature is always preserved.¹¹⁹

After a brief excursus, Aristotle continues:

There must be some natural (*phusin*) substance, either one or many, which is preserved while other things come to be. On the number and form of this principle there is no agreement, but Thales, the originator of this sort of philosophy, said that it is water (and so declared the earth to be upon water). Taking his hypothesis from observing the nurture of all things to be moist, the warm itself coming to be from this and living by this (that from which they come to be being the principle of all things). He took the hypothesis from this and the fact that the seeds of all things have a moist nature, water being the natural principle of all things moist.¹²⁰

There is then the general principle that everything can be explained as being generated from or being destroyed back into water. The second passage here emphasises

that Aristotle, generally for the Milesians and specifically for Thales, sees a natural substance as key to this process. Whether Aristotle construes this entirely accurately does not alter the basic issues here. Aristotle is usually taken as saying that for Thales, everything is always water as water is the substance that underlies all changes. The alternative is that Thales believed that earth, air and fire are generated from water but are not actually water. Under either interpretation, it is clear that water is seen as entirely natural and so are all of the other things water can change into. As with Anaximander and Anaximenes, there is no extended world for Thales. It is also notable that there is evidence that:

Thales said necessity is strongest for it exercises power over everything.¹²¹

That would at least suggest that everything happens in a law-like manner for Thales.

The investigation of nature

Certainly the ancient Greeks seem to have considered Thales to be part of the investigation concerning nature. Simplicius tells us that:

Traditionally Thales is held to be the first to reveal the investigation of nature (*periphuseôs historian*) to the Greeks. He had many predecessors, as Theophrastus too believed, but he so far excelled them as to obscure all those who came before.¹²²

Aristotle also says that:

Others say the earth rests on water. This is the oldest account we have, given they say by Thales of Miletus, that it remains in place by floating like a piece of wood or something similar, (of these things none rest on air, but on water), as if the account concerning the earth did not apply to the water supporting the earth.¹²³

It is also worth noting in relation to this that Thales explained earthquakes naturally. Seneca tells us that:

Thales said that the earth is held up by water and rides on it in the manner of a ship. When it is said to quake it is rocking due to the motion of the water.¹²⁴

Similarly Pseudo-Plutarch says that:

Thales and Democritus attribute the cause of earthquakes to water.¹²⁵

Prior to Thales we find Poseidon ‘the earth shaker’ as the cause of earthquakes in Homer. Thales also gave a natural explanation for floods of the Nile, that winds held back water in the Nile.¹²⁶

Thales on cosmogony and cosmology

We have relatively little information about Thales' cosmogony and cosmology. The only further information we have comes from Heraclitus Homericus:

The moist nature, since it is easily remodelled into each thing, is accustomed to undergoing many varied changes. That which is exhaled becomes air, and the finest part of this is kindled into aether, and when water collapses it changes into mud and land. Therefore of the four elements Thales declared water to be basic, and, is it were, the cause.¹²⁷

It is generally reckoned though that as a parallel to Anaximander and Anaximenes, Thales believed the world to start as water and the cosmos to be developed out of that. Certainly Aristotle places Thales quite firmly among the first philosophers. If the other Milesians set a typical pattern (and differences in this would certainly be commented on by Aristotle and later commentators)¹²⁸ then the processes of cosmogony are ongoing processes that we can see happening in the world around us. In contrast to theogony and myth where there are singular incidents, based on the arbitrary wills of super beings, Thales' cosmogony does not need anything more than the ordinary cycle of the elements beginning from water.¹²⁹

As with magic, contrast is important. Here are four accounts of creation which do use non-natural beings and/or processes and the contrast with Thales' scheme is quite marked. This also applies to Anaximander and Anaximenes, and later presocratics. The main Babylonian account of creation is to be found in the epic *Enuma Elish* (When Above), which takes its name from its opening words. It is likely that this was composed during the first Babylonian dynasty (2057–1758 BCE).¹³⁰ Like the Egyptians with the Nile, the Babylonians had the flooding and receding of the Tigris and Euphrates, so again we have the first dry land emerging from water. These are the opening few lines of an epic that stretches over seven tablets, most of which are around 130 lines long.¹³¹

When above the heavens had not yet been named
 And below the earth had not been called by a name
 When only Apsu primeval, their begetter existed
 And mother Ti'amat, who gave birth to them all
 When their water still mixed together
 And no dry land had been formed and not even a marsh could be seen
 When none of the gods had yet been brought into being
 When they had not yet been called by their names, and their destinies had not
 yet been fixed
 Then were the Gods created in the midst of them.¹³²

There are many other Babylonian creation tales, the most significant of which is the tale known as the *Eridu Genesis*. The tablet this is taken from has been dated to the sixth century BCE, though of course the tale itself may be much older.¹³³

As the Nile flooded and receded each year a central feature in Egyptian creation tales was the emergence of dry land from water. Nile mud was exceptionally fertile,

and given the abundance of life forms which emerged from it, one can easily see how it might have been thought to have life-giving properties. This passage is from a dedication ritual in a royal pyramid, dating from around the twenty-fourth century BCE.

O Atum-Kheprer, you were on high on the primeval hill. You arose as did the *ben*-bird of the *ben*-stone in the *Ben*-House in Heliopolis. You spat out what was Shu, and sputtered out what was Tefnut. You put your arms around them as the arms of *ka*, for your *ka* was in them. So also, O Atum, put your arms around King Nefer-ka-Re, as the arms of *ka*. For the *ka* of King Nefer-ka-Re is in it, enduring for the course of eternity ... O Great Ennead which is in Heliopolis, Atum, Shu, Tefnut, Geb, Nut, Osiris, Isis, Seth and Nephthys whom Atum begot, spreading wide his heart in joy at his begetting you in your name of the Nine Bows.¹³⁴

We can also contrast some Greek sources here. One Orphic account of creation is that:

Water was the origin of all things, according to Orpheus, and from water mud was deposited, and from these a life form was generated a snake with the head of a lion growing on it, and between these grew the face of a God, Heracles and Kronos by name. This Heracles generated an enormous egg, completely filled with the force of its creator, broke into two due to rubbing. The upper part became Ouranos, and the lower part became Ge, and a double bodied God came forth. Ouranos and Ge had intercourse and generated the females Cloetho, Lachesis and Atropos.¹³⁵

So too we have Hesiod's account at the beginning of the Theogony:

First a chasm was generated, then broad-breasted Gaia (earth), a safe seat for all forever,¹³⁶ and misty Tartarus in a recess of the broad earth, and Eros, most beautiful of the immortal gods, relaxer of limbs, who subdues in their breasts the sense and intelligent counsel of all gods and all men. From the chasm, Erebus and black night were generated. From night, aether and day were generated, who she bore after sex with Erebus. Earth first generated something equal to herself, starry Ouranos, in order that she should be entirely covered, to be a safe seat for the blessed gods forever. Then she generated large mountains, happy haunts of the divine Nymphs who live in the wooded mountains. She also bore the unharvested sea, with its rolling swell, Pontos, but not in union of love. Then having had sex with Ouranos she bore deep-eddyding Okeanos.¹³⁷

Sources for Thales

There has been considerable debate about the sources and inspiration for Thales' water cosmogony/cosmology. There have been those, both ancient and modern, who have given reasons why Thales chose water independent of any context. So Aristotle¹³⁸ and Heraclitus Homericus¹³⁹ did not believe that Thales borrowed from myth, and gave what he believed to be Thales' reasons for choosing water. O'Grady has pointed out that water is a good choice for a theory of matter/change in that it can be readily seen

to evaporate to form air, to silt to form earth, is critical to all life forms and might be thought to be critical to spontaneous generation as well.¹⁴⁰

On the other hand, there is the immediate historical context of Egyptian and Babylonian creation tales as well as the Orphic account, all of which envisage the generation of the world out of water. It is easy to suppose that Thales was influenced by or took inspiration from these accounts. Such a view is one way of trying to minimise the differences between Thales' views and those of his predecessors.

A different approach is to suggest that Thales deliberately targets these accounts. Here we have accounts which invoke the non-natural to explain how the world and life have come to be from water. Thales has an account which involves water but pointedly not the non-natural.

Evidence is sparse for all of these possibilities. Thales may have had purely philosophical reasons for choosing water or the evidence we have for this, such as it is, may be some post hoc rationalization from Aristotle. Certainly there were many water-based creation tales prior to Thales which may have influenced his view but we have no direct evidence he was influenced in this way. So too there is no direct evidence that Thales targeted water-based creation tales, though there does seem to be a pattern of targeting important cases among the presocratics and Thales would fit in well here.

Thales and gods?

The case against Thales is that he may well have believed in an active role for a god or even many gods. The evidence is sparse and unclear as to the nature and role of god but clear enough that Thales believed in some form of god. Aristotle tells us that:

Thales supposed the soul to be capable of generating motion, as he said that the magnet has soul because it moves iron.¹⁴¹

Diogenes Laertius confirms this:

Aristotle and Hippias say that Thales gave a portion of soul to soulless entities, citing the Magnesians stone and amber as proofs.¹⁴²

Aristotle goes on to say:

Some believe soul pervades the whole *cosmos*, and perhaps this is the source of Thales' view that everything is full of gods.¹⁴³

Aetius tells us that for Thales:

The mind of the *cosmos* is God, that all things are ensouled and are full of demons, extending to the elemental moisture, there is a divine power capable of moving it.¹⁴⁴

Stobaeus says that:

Thales asked what is oldest? God, for he is ungenerated.¹⁴⁵

Cicero comments that:

Thales of Miletus, who was the first to investigate these questions, said that water was the principal substance, god being the mind which fashioned everything out of water.¹⁴⁶

What ought we to make of these passages? Thales requires an explanation of self-motion, and supposes soul to be the source of this.¹⁴⁷ It is possible that Thales' view was of soul pervading the universe, and this was later corrupted, even by Plato and Aristotle's time, to the idea that everything is full of gods. It is also possible that Thales meant there was a unitary cosmic intelligence but expressed this slightly loosely as 'all things are full of gods'.¹⁴⁸ The later doxography is problematic because of the tendency of some Stoic, Neoplatonist and Christian commentators to attribute a belief in god, and a god who generates the *cosmos*, wherever possible. The passages here from Stobaeus and Cicero still have some value however. Thales may well have believed in some form of cosmic soul or intelligence, which Aetius calls the mind of God, capable of giving things motion. The Cicero passage is interesting, for while we suppose the cosmos to have come from water for Thales, we do not know how the cosmos became organised. One possibility is that a cosmic intelligence inherent in water guided the processes which brought a *cosmos* into being out of primordial water. Cicero then interpreted that cosmic intelligence as a God. Here I disagree with KRS, who considers this passage to be 'recognizably fictitious'.¹⁴⁹ Certainly the passage is recognizably Stoic in its phraseology, but that does not rule out the idea that Thales believed in some form of cosmic intelligence which was then given a Stoic gloss by Cicero.

As we have seen with Anaximander, the idea that there is some form of cosmic steering or intelligence behind either motion or intelligent design is not problematic. Thales believed in nothing that was beyond nature and nothing that had variable behaviour. The final issue is whether Thales believed in a multiplicity of gods, that all things are full of gods. One part of the evidence here comes from Plato's *Laws*:

Is there anyone who will hold this and maintain that all things are not full of gods?¹⁵⁰

It is notable though that Plato is pushing the notion of invariance very strongly at this point in the *Laws* and is arguing that the heavenly bodies could not move in such a precise manner if they did not have souls. Whether Thales believed in many gods or one god there is no evidence then that Thales considered soul or god to be outside of nature or to be in any way invariant. The 'generated out of and destroyed into' formula looks invariant. Aristotle considers water to be a natural substance for Thales. It is notable that Aristotle here does not distinguish Thales from the other Milesians in this respect and that Plato has no critique of Thales in this respect either. It is not problematic that Thales or the other Milesians considered their principal substance to be divine. They clearly have in mind some form of pantheism/panpsychism, and one where the principal substance behaves in an invariant and predictable manner.¹⁵¹ So I would disagree with Betegh who comments that:

It was Zeus who rained, and the sea stormed because Poseidon was angry. Although we are not sure how exactly Thales meant it, his dictum that 'everything is full of gods' (DK 11 A22) seems a fair representation of the Greek experience.¹⁵²

I agree that we cannot be exactly sure how Thales meant this phrase, but I would say the balance of evidence is that Thales would have opposed the traditional conception of the gods.

Conclusion

There was no belief in the non-natural among the Milesians. There is no extended world for them. There was a form of pantheism, perhaps best termed pansychism, whereby matter is steered into good order and held in good order. There is though nothing which exists outside of nature and nothing which behaves in an irregular manner.

Anaximander's meteorology is extremely important here. It is very hard to believe that it is coincidental that the five meteorological phenomena that Anaximander gave natural explanations to are the same five phenomena in two lines of a famous passage in Hesiod, where they are given non-natural explanations. It is possible that a later thinker (Aristotle?) generated this category and then doxographers fitted otherwise disparate views of Anaximander into this category. I have argued though that there are good reasons to believe that this grouping of phenomena is original to Anaximander.

If so, that is important for three reasons, First, Anaximander has a conscious, direct rejection of Hesiod favouring natural explanations for these phenomena. Second, Anaximenes follows directly in Anaximander's footsteps. Third, as we shall see, there is a tradition of talking about this group of five meteorological phenomena throughout the presocratics. That tradition is then not accidental, but based on Anaximander and his rejection of Hesiod.

This is important for two related themes of this book. First, that the presocratics targeted important, interesting and difficult phenomena for explanation and that they targeted famous passages in Homer and Hesiod where we find non-natural explanation. Second, that the instances where we find the presocratics rejecting non-natural explanations are not a loose grouping of disparate instances but are linked together as part of an agenda for at least some of the presocratic thinkers.

Anaximander's theories, though of course woefully inadequate by modern standards, do have quite a lot going for them in context. Structurally, there is little wrong with them. There is more to them in empirical terms than is sometimes allowed. Anaximander's theories in cosmogony and zoogony assume that the processes which led to the formation of the cosmos and life are still happening and that we can form theories by observing the world around us.

Next we move on to the Hippocratics, where we will see some interesting similarities to the Milesians, not least in more targeting of phenomena presumed to be non-natural and more views on pantheism and the cosmos being steered.

The Hippocratic *On the Sacred Disease*

I do not propose to address the entire Hippocratic corpus in this chapter. That, on its own, would be at least the work of another book. The Hippocratic Corpus is a group of between 60 and 70 treatises, most of which were written between 430 and 330 BCE, though some are later.¹ Which, if any of these, were written by Hippocrates is a matter of ongoing debate.² They cover a wide range of medical subjects and are diverse in style, ranging from detailed observations of patients, to textbooks on procedure, to more theoretical works.

The first Hippocratic work I wish to look at is *On the Sacred Disease*, dating to the late fifth century or the early fourth century BCE. The ‘sacred’ disease in question is epilepsy, which was seen throughout the ancient near east as a clear case where either gods or demons had caused the disease. *On the Sacred Disease* is important for this chapter in that while it appears to reject the non-natural causation of disease, whether *On the Sacred Disease* rejects the non-natural altogether has been a matter of debate. Gomperz is the classic statement for naturalist tradition,³ while Edelstein is the classic statement of the non-natural view with many contributions following on from these.⁴ Miller puts the issue like this:

The attempt of the author of the ‘Hippocratic’ work, *De Morbo Sacro*,⁵ to destroy the popular belief in the supernatural causation of the ‘sacred’ disease has long, and justly, been regarded as one of the earliest and most significant expressions of the self-consciously rational spirit in early Greek medical thought.⁶

While Porter praises the Hippocratics for

A healing system independent of the supernatural and built upon natural philosophy.⁷

On the other hand, Edelstein’s view is that

It seems impossible to contend that every form of supernaturalism was rejected by the Hippocratic physicians.⁸

Fowler comments that

On the *Sacred Disease*, is justly celebrated for its rationalistic rejection of spells and other magical procedures. It heaps scorn upon charlatans who claim to be

able to cause eclipses of the sun or make it rain. Surely, one might say, this is proof that magic was beginning to be regarded merely as the activity of unenlightened, superstitious peasants. Yet this same doctor is quite willing to believe that sleeping in the sanctuary of Asklepios can cure you, and the writers of these treatises elsewhere display a willingness to call upon divination, dreams, and other quite irrational resources to work their wonders.⁹

At stake here is not just the local issue of whether *On the Sacred Disease* entirely rejected the non-natural. One of the themes for this book is presocratic targeting of non-natural belief, where there are difficult or important cases, and targeting of non-natural beliefs in Homer and Hesiod. Epilepsy might be thought to be a difficult and important case for natural explanation.¹⁰ The idea that diseases in general are caused by the gods was common in the ancient world and prominent in famous passages of Homer and Hesiod, the plague in the opening passage of the *Iliad* and Pandora's box in *Works and Days*.¹¹ I will argue that there are several other interesting instances of targeting non-natural belief, particularly in relation to Homer.

As I want to suggest that the Hippocratics, like the Milesians target important non-natural beliefs,¹² I will also be looking at ways in which there are other commonalities of interests and approaches between the Hippocratics and the Milesians. *On Regimen* I/10, examined in the next chapter, is important here but there will be other considerations as well. Second, I want to explore some possibilities for religious belief for the ancient Greeks. The debate concerning *On the Sacred Disease* can polarise into two camps. The author mentions piety. Those who take him literally then ascribe to him a belief in a non-natural god. Those who take him to be polemical and metaphorical do not. Question: can a pantheist be pious? If the answer to that is yes, then there is the possibility that the author can be taken literally and have an entirely natural view of the world, which may go a good way to resolve the debate.

A final comment before we begin looking at *On the Sacred Disease*. Is the Hippocratic corpus entirely consistent in how it uses key terms for our discussion such as 'divine'? No, it is not, not on this nor on several other issues. As the Hippocratic corpus was written by many authors over many years, quite probably without many of the authors realising their work would end up as part of this corpus, it is hardly surprising that there are inconsistencies between works. Do I wish to claim that all the Hippocratic writers entirely rejected the non-natural? I will certainly look at that claim. Whether it fully succeeds may depend on quite how we understand what can be done with pantheism and what we understand by the non-natural. Even if this claim is not fully successful, in my view the Hippocratics come remarkably close to disposing of the non-natural entirely. Does it matter if not every Hippocratic writers entirely rejected the non-natural? No, I do not think that it does. The claim of this chapter is not that all Greeks rejected the non-natural cause of diseases, but at least some of them did, in line with the claim of this book is not that all Greeks rejected the non-natural, but at least some of them did.

Ancient aetiology of disease

I first want to emphasise the background of how epilepsy was seen as a disease in the ancient world.¹³ Wilson and Reynolds, in their paper on a Babylonian tablet which deals with epilepsy, say that:

The first point to be made is that to Babylonian science, as to the Babylonian *as'ipu* – the 'doctor' and 'scholar' most closely involved – it was clear that the manifestations of epilepsy were the work of demons and ghosts.¹⁴

To quote the opening line of this tablet:

If epilepsy falls once upon a person or falls many times, it is as the result of possession by a demon or a departed spirit.¹⁵

The tablet also says that 'If an epilepsy demon has fallen once upon him' and wants to generate a contrast with cases where 'If an epilepsy demon falls from time to time upon him' and 'If an epilepsy demon falls many times upon him'.¹⁶ Slightly later on in the tablet, again in reference to epilepsy, we get: 'If the possessing demon has been possessing him again and again.'¹⁷ This fits well with the more general Babylonian background that all diseases are due to the intervention of gods or demons.¹⁸

Also important here is the background of Homer and Hesiod. While neither mention epilepsy specifically, both subscribe to the notion that the gods inflict diseases on humankind. This passage from the *Iliad* is notable as it is the opening passage of the work:

Sing, goddess, the wrath of Achilles Peleus' son, the ruinous wrath that brought on the Achaeans woes innumerable, and hurled down into Hades many strong souls of heroes, and gave their bodies to be a prey to dogs and all winged fowls; and so the counsel of Zeus wrought out its accomplishment from the day when first strife parted Atreides king of men and noble Achilles. Who among the gods set the twain at strife and variance? Apollo, the son of Leto and of Zeus; for he in anger at the king sent a sore plague upon the host, so that the folk began to perish, because Atreides had done dishonour to Chryses the priest.¹⁹

To relieve the plague,²⁰ there is no question of any cure, except trying to assuage the anger of the gods.²¹ This passage from Hesiod does not occur in quite such a prominent position in his works, but his view is clear enough:

But for those who practise violence and cruel deeds far-seeing Zeus, the son of Cronos, ordains a punishment. Often even a whole city suffers for a bad man who sins and devises presumptuous deeds, and the son of Cronos lays great trouble upon the people, famine and plague together, so that the men perish away, and their women do not bear children, and their houses become few, through the contriving of Olympian Zeus.²²

If we want another sample view from the ancient near east, we can also look to the Bible, where in the New Testament Mark tells us that:

14 And when they had come to the multitude, a man came to Him, kneeling down to Him and saying, 15 'Lord, have mercy on my son, for he is an epileptic and suffers severely; for he often falls into the fire and often into the water. 16 So I brought him to Your disciples, but they could not cure him.' 17 Then Jesus answered and said, 'O faithless and perverse generation, how long shall I be with you? How long shall I bear with you? Bring him here to Me.' 18 And Jesus rebuked the demon, and it came out of him; and the child was cured from that very hour.²³

The idea that illness in general, and epilepsy in particular is caused by gods or demons is then widespread in the ancient world. *On the Sacred Disease*, in typically aggressive fashion, explains the origins of the idea that epilepsy is divine by saying:

In my opinion the first men to consider this disease to be sacred were like those we now call mages, purifiers, vagabonds and quacks. These people claim for themselves great piety and much knowledge. They used the divine as a cloak, having no treatment or anything useful to offer, and in order that their lack of knowledge should not be evident, they called this condition sacred.²⁴

The author is clearly aware of the background here and is in no doubt who his targets are.²⁵

The Hippocratics

The positive case for the author of *On the Sacred Disease* is then that they reject the idea that epilepsy is caused by the gods and emphatically state that it has a natural cause. One can put this rather more strongly though. It is not just epilepsy which is natural, but all diseases are natural. It is also interesting and significant that the Hippocratic author takes on what might well have been considered to be the hardest case in attempting to demonstrate that all diseases have a physical cause and none have their origin with the gods. This, in line with one of the main themes of this book, can be seen as an example of presocratic targeting. That in turn can be seen in two ways. First, the most difficult case is being taken on. Second, while Homer and Hesiod do not specifically mention epilepsy, their view on disease in general is clear and the Hippocratic author puts forward the view that all diseases, which would include the plague, have a natural origin.²⁶ The author bluntly denies that the sacred disease is caused by the gods or that its nature is different from that of other diseases. The opening passage of *On the Sacred Disease* is:

Concerning the disease which is called 'sacred'. In my view it is no more divine or sacred than any other disease, but has a nature and a definite cause. Men have called it divine due to their inexperience and great wonder, it being unlike other diseases.²⁷

It is possible to find similar sentiments elsewhere in the Hippocratic corpus, for instance in *On Airs, Waters and Places* and in *On Breaths*.²⁸ Throughout *On the Sacred Disease* one can find straightforward assertions like:

This disease is generated by and grows due to what comes into the body and what leaves it, it is no more difficult to cure or understand than other diseases, and is no more divine than the others.²⁹

On the Sacred Disease also says that:

This is best seen with cattle who are attacked by the disease, especially goats. They are most commonly seized. If you cut open the head you will find that the brain is wet, full of fluid and foul smelling, so clearly one recognises that it is not a god which is harming the body, but the disease. So too with humans.³⁰

Not being able to perform human post-mortems, the Hippocratics performed post-mortems on goats who appeared to suffer from a similar disease to epilepsy and concluded that the disease had a natural basis. We cannot be sure this actually took place,³¹ though the comment that the contents of the head were 'foul smelling' might well suggest that it did and we will find a similar investigation from Anaxagoras into a supposed unicorn.³² *On the Sacred Disease* Ch. XVI further tells us that:

This disease is born and grows from that which enters and leaves (the body), it is no more intractable than the others, nor is it incurable or unintelligible, and is no more divine than the others.³³

The final section, XXI, of *On the Sacred Disease* opens on a thoroughly optimistic note by saying:

The so-called sacred disease is produced by the same causes as other diseases, from what enters and leaves the body, from cold, sun and the changing winds which are never resting. These things are divine, such that there is no need to distinguish this disease from the other diseases, they are all divine and they are all human. Each disease has its own nature and power and none are intractable or untreatable (*ouden aporon ... oude amêchanon*).

These comments are best seen as programmatic and against the background of the final lines of *On the Sacred Disease*:

Anyone who knows how to produce in men dryness or wetness, cold or heat by means of regimen, can cure this disease as well, if he can distinguish the due times for treatment, without needing purifications or magic.³⁴

General attack on magic

A further important aspect of *On the Sacred Disease*, as Lloyd has argued, is that it makes a general attack on magic and magicians.³⁵ It is not just epilepsy which has a natural cause, but all diseases. It is not just that there are incompetent practitioners of magic in relation to healing, the whole practice is entirely unfounded. Although the main focus of *On the Sacred Disease* is medical, there is a parallel attack on other magical practices as well. The author says that:

If a human by magic and sacrifice can bring down the moon, eclipse the sun, make storm and good weather, I will not call these things divine, but human, since the ability of the god is overpowered and enslaved by the knowledge of humans.³⁶

This is interesting for its breadth of attack on magical claims and practices. It is also interesting and highly significant that the Hippocratic author, even in this hypothetical example, will not allow something that is both non-natural and effective. If humans can achieve these things by magic and sacrifice, then these acts are human and not divine. The Hippocratic author interestingly does not distinguish between humans who are capable of this magic and humans who are not and does not seem to recognise the idea that some humans might have magical abilities and others not. The Hippocratic author continues from the passage above with the following acerbic remarks:

But perhaps this is not true and these men, being in need of a living,³⁷ fashioned and embellished many tales of all types, about many things and about this disease in particular, placing the blame for each form of this condition on some god.³⁸

This all looks very promising as an apparent rejection of magic and the non-natural. *On the Sacred Disease* continues in its sceptical manner:

They have instituted a mode of treatment which is safe for themselves, namely, by applying purifications and incantations, and enforcing abstinence from baths and many articles of food which are unwholesome to men in diseases ... And they forbid to have a black robe, because black is expressive of death; and to sleep on a goat's skin, or to wear it, and to put one foot upon another, or one hand upon another; for all these things are held to be hindrances to the cure. All these they enjoin with reference to its divinity, as if possessed of more knowledge, and announcing beforehand other causes so that if the person should recover, theirs would be the honour and credit; and if he should die, they would have a certain defence, as if the gods, and not they, were to blame, seeing they had administered nothing either to eat or drink as medicines, nor had overheated him with baths, so as to prove the cause of what had happened.³⁹

It is worth noting that there are healing songs in Homer, though the attack on incantations is quite general.⁴⁰ We are about to move on to discussing the Hippocratics and the divine. Something I tried to emphasise in the section on magic in the introductory chapter to this book was the gulf in world view and practice between the presocratic magicians and the presocratic philosopher/scientists. That gulf is sometimes forgotten when we debate the finer points of whether the philosopher scientists fully rid themselves of all aspects of magical or non-natural thinking. I would reiterate that here in relation to the Hippocratics on a smaller scale and I would emphasise two points. First, look at the gulf between the Hippocratic author here and the magical ideas and practices that they describe. Second, there are a great many Hippocratic texts where there is no issue that all explanation is done in an entirely natural manner. This is so for, e.g. the *Epidemics*, even where no cause is evident for a disease and in many works the divine is not even mentioned.⁴¹

Natural and divine?

It would be wrong though to see this rejection of the non-natural as an outright rejection of the divine. The Hippocratic author does not deny the existence of the divine, but *On the Sacred Disease* XXI says in relation to epilepsy that:

Therefore there is no need to distinguish this disease from others or consider it more divine, for they are all divine and all human.⁴²

The contention throughout *On the Sacred Disease* is not that there is no such thing as the divine but that epilepsy is no more and no less sacred than any other disease. How are we then to understand this reference to the divine? One solution, which is attractive in many ways, is pantheism. Van der Eijk comments that:

In this theology the divine is regarded as an immanent natural principle (or as a certain group of concrete natural factors) and is no longer conceived as something supernatural. Consequently the influence, or the manifestations, of the divine are regarded as natural processes and no longer as supernatural interventions of gods within natural or human situations.⁴³

As we shall see, van der Eijk does not think this quite fits all the author of *On the Sacred Disease* has to say, but it is a good characterisation of the pantheist interpretation.⁴⁴ One objection to this pantheist view is what Hankinson has termed 'The Explanatory Vacuity of Pantheism.'⁴⁵ He says that:

One might argue, either on positivist or pragmatist grounds, that unless the hypothesis that there is a divine component to things can make some difference, either to what (in principle) verifiable predictions we can make or to our actual practice, then such suppositions are devoid of content.⁴⁶

Certainly one might be concerned about what difference it makes whether the world about us is considered to be divine in the pantheist sense or not. Hankinson's reply to this is that:

Nature is divine because of its intricacy, regularity and teleological structure; natural processes, in their goal-directedness and their striving for a type of immortality, seek to emulate the divine condition. Yet even if nature is divine in more than merely a metaphorical sense, there is still no point in appealing to it as one might a powerful patron. This sort of divinity, in sharp contrast with the angry, engaged, interventionist gods of epic and tragedy, is not open to plaint or suasion, much less magical coercion.⁴⁷

I would add two points to this. First, we saw that there was explanatory import with Milesian panpsychism. Anaximander's divine *apeiron* steered, having an important function in cosmogony and in the ongoing behaviour of the universe. A non-divine universe would not have this steering function, this ability to organise itself out of a condition of complete uniformity and to maintain itself. One might take the view that a non-divine world in this sense of steering would not have this degree of organisation or

this degree of stability. Against this view one would have to say that it is not possible to tie Anaximander in directly with *On the Sacred Disease*. However, as we shall see in relation to the Hippocratic *On Regimen*, it is possible to tie similar themes from the Milesians in with the Hippocratic corpus.⁴⁸ Second, there is the related point that the cosmos for ancient Greeks could be both aesthetically and morally good as well as displaying good order in the sense of law like behaviour.⁴⁹ If it is perceived that this cosmos is indeed aesthetically and morally good, that sets it apart from arrangements which are not. While the term 'cosmos' is not found in *On the Sacred Disease*, the idea of the world as a cosmos, a well-ordered, aesthetically and morally good place would have been around at the time.

This second point is also important for another reason. If the world about us is perceived to be aesthetically and morally good, it may then be an object of adoration, veneration, reverence, even worship, even piety. It might also be an object to be honoured, a key notion in Greek religion being proper honour for the gods.⁵⁰ One might hold that there are proper attitudes and proper actions towards a world so conceived. To have the proper attitudes and do the proper actions is pious. There is no reason, either generally or within Greek religious observance, that piety should be restricted to the relationship between a human and a god which exists independent of the natural world. So returning to our passage from *On the Sacred Disease* XXI, I would disagree with Martin who says that

Given such a straightforward statement, it is odd that so many modern interpreters have taken the writer to be arguing, on the contrary, that the gods and 'supernatural' forces have nothing to do with disease.⁵¹

With the pantheist option, the gods have nothing to do with the disease and there is nothing here that is either non-natural in the modern sense or non-natural for the presocratics.

Against the naturalist view

Against the view that *On the Sacred Disease* gives us an entirely natural account of epilepsy, disease in general and perhaps natural phenomena in general as well, van der Eijk has commented that:

It has been recognized by several interpreters that the author's criticism of the magicians, which occupies the entire first chapter of the treatise (and which is echoed several times later on in the treatise), reflects an authentic religious conviction ... The religious conviction which apparently underlies these passages is far more traditional and less 'advanced' than the naturalistic theology which is reflected in the statements on the divine character of the disease, since it appears that the author of MS⁵² believes in a supreme divine power which cleanses men of their moral transgressions and which is accessible to cultic worship in sacred buildings by means of prayer and sacrifice.⁵³

There are two sorts of reply one might make to this. First, one might look to the hypothetical and *ad hominem* nature of the arguments in the early part of *On the*

Sacred Disease. The author's own beliefs are not the issue here. What is at issue here is the coherence of the beliefs of those who believe epilepsy to be sacred and other diseases to be non-sacred. They claim to be pious but their views lead to gross impiety. They claim a belief in god but their views actually lead towards atheism.

The second line of approach, which can be used independently of or in conjunction with the first approach, if that is not felt to clear up all the issues, is to ask whether the author commits themselves to anything which would be problematic for the pantheist interpretation? It should be clear that admitting the existence of the divine is unproblematic. If it is possible to have an attitude of reverence or piety for nature/the divine, as I have suggested above, then a claim to personal piety, rather than an attack on others' views is not problematic for the pantheist interpretation either. Similarly a pantheist believes there to be a god, identical with nature and is in a position to criticise atheists, who do not believe in the divinity of nature.

There has been debate about the 'religiosities' of *Airs, Water, Places* and *On the Sacred Disease*, and whether they exhibit similar 'religiosities'.⁵⁴ I take the somewhat deflationary view that both *Airs, Water, Places* and *On the Sacred Disease* can be analysed in terms of the two approaches we have just looked at and both have pantheist 'religiosities', if that is an appropriate term to be applied to pantheism.⁵⁵ I also think that van der Eijk's talk here of a 'supreme divine power' pushes the evidence a little too far. I have suggested that pantheism may be the best way to understand *On the Sacred Disease*. That is different from an assortment of independent gods, but that is different again from the idea of a 'supreme divine power'. The evidence might be thought to support multiple independent gods but I cannot see that it supports the idea of a single 'supreme divine power'.

Polemical context

As the author of *On the Sacred Disease* contrasts the divine and the human and concludes that all diseases are both divine and human, some commentators have been concerned over what the difference between divine and human in relation to diseases is for the author.⁵⁶ Some have sought to explain this in terms of the origin of the disease, looking to passages such as the beginning of Ch. XXI where 'cold, sun and the changing winds' are divine and are the cause of epilepsy. Alternatively, a disease may be divine because it has a *phusis*, a definite pattern of development.⁵⁷ Here I follow Mansfeld's suggestion that the context of the remarks about diseases being both divine and human is polemical.⁵⁸ It is the opponents' position is that some diseases are divine, some are human. It is the author's view that there is no such distinction and as such all diseases are, in this terminology, both divine and human. It is important to recognise the polemical context of the Hippocratic works such that this attack on opponents is no surprise. The Hippocratics were not the only people offering cures in the fifth and fourth centuries BCE. They were in direct competition with midwives, root-cutters, herbalists, purifiers, purveyors of charms and incantations, gymnastic trainers, drug sellers, bone-setters, exorcists and surgeons as well as the cults of Apollo and Asclepius.⁵⁹

Van der Eijk has rightly pointed out though that the author of *On the Sacred Disease* makes some comments about the divine and about pollution which are separate from other remarks which could be considered hypothetical and polemical. Here is van der Eijk's translation of what he considers to be the key passage, of which he says 'It seems that if we are looking for the writer's religious convictions we may find them here':⁶⁰

But I hold that the body of a man is not polluted by a god, that which is most corruptible by that which is not holy, but that even when it happens to be polluted or affected by something else, it is more likely to be cleansed from this by God and sanctified than to be polluted by him. Concerning the greatest and most impious of our transgressions it is the divine which purifies and sanctifies us and washes them away from us; and we ourselves mark the boundaries of the sanctuaries and the precincts of the gods, lest anyone who is not pure would transgress them, and when we enter the temple we sprinkle ourselves, not as polluting ourselves thereby, but in order to be cleansed from an earlier pollution we might have contracted. Such is my opinion about the purifications.⁶¹

Van der Eijk's view on this passage is that 'the author believes in the purifying and cleansing working of the divine'⁶² and more programmatically that:

He believes in gods who grant men purification of their moral transgressions and who are to be worshipped in temples by means of prayer and sacrifice.⁶³ It is difficult to see how this conception of 'the divine' (*to theion*) can be incorporated within the naturalistic theology with which he has often been credited.⁶⁴

On this I disagree, as I believe all of this can be incorporated into a pantheist view. If there are proper attitudes and actions towards nature, as I suggested above, then there can be improper ones as well. If we have taken part in improper attitudes and actions, then we may need to make recompense. In doing so we re-assimilate ourselves to nature. That there should be places of worship for a divine nature is entirely unproblematic. The only problem I see here is the use of gods in the plural, but that may be a loose metaphorical use (meaning divine nature). So I would agree with Miller, who comments about *On the Sacred Disease*'s author that:

His remarks reflect, indeed, a genuine belief in the Divine, but, as perhaps in the case of a Socrates or a Euripides, it is not simply a belief in the gods as traditionally and popularly conceived.⁶⁵

All phenomena natural?

We do need to be cautious though about any proposed identification of the natural and the divine in *On the Sacred Disease*. As van der Eijk has argued, this is not explicit in the text, nor is it explicit that all phenomena, in addition to all diseases, should be considered to be both natural and divine. That is so. However it is possible to make the case that all phenomena are both natural and divine in *On the Sacred Disease*. The first point to make here is that the task of *On the Sacred Disease* is to argue that epilepsy is

no more divine than any other disease and more broadly that all diseases are equally divine. It is no great surprise that a more general view of all phenomena is omitted, whatever the author's view. This is not a more general work of philosophy intended to argue that all phenomena

Having said that, there are passages which can be taken as asserting that more phenomena. One might well read *On the Sacred Disease* IV/1–5, as asserting that the activities of the sun and the moon, and meteorological phenomena such as storms and good weather, rain and drought are all natural phenomena. Certainly one should read *On the Sacred Disease* XXII as giving us 'cold, sun and the changing winds' as phenomena which are both divine and natural.

Two important points come out of this. First, given such a catalogue of important phenomena as natural, along with all diseases, the step to 'all phenomena are natural' is not very far. Second, we again see an insistence that meteorological phenomena are entirely natural and that meteorological phenomena are given prominence in discussions of the natural. This is important in tying the Hippocratics in with the presocratic philosophers in their assault on phenomena commonly taken to be non-natural. We might also consider two passages from other Hippocratic works. Firstly, from *On Airs, Waters and Places*:

I believe that these conditions are divine and so are all others, none being more divine or human than any other, all are alike and all divine. Each of them has its own nature and nothing occurs without a natural cause.⁶⁶

Our second passage is from *On the Art*:

Under closer examination the spontaneous does not appear, as everything which occurs does so on account of something, and this 'on account of' shows that the spontaneous has no existence and is just a name.⁶⁷

For each of these passages here is a deflationary and an expansive view. The deflationary view is that in each case the reference is to diseases and diseases only. They are natural, but other phenomena are not under consideration here. The more expansive view simply is that all phenomena, including but not only diseases are the subject here, and that all phenomena are natural. The great temptation is to assimilate these passages to a seemingly extremely strong and programmatic fragment of Leucippus:

Nothing happens at random (*matên*),⁶⁸ but everything for a reason and by necessity.⁶⁹

That should probably be resisted, as there is nothing so strong or clear in the Hippocratic corpus.⁷⁰ I would add one theoretical consideration though, which is that if the author of *On the Sacred Disease* was a pantheist, we would indeed expect all phenomena, not just diseases to be natural and divine. I see nothing in *On the Sacred Disease* which contradicts that, even if we do not have a fully programmatic statement of it, which we would not expect in such a treatise.

Other non-natural passages?

While I do not intend to deal with the entire Hippocratic corpus in this chapter, there are a couple of other passages which have been examined in the literature and thought problematic for a naturalist interpretation. The first is from *On Prognosis*:

One must understand the natures of such diseases, how far they exceed the power of the body [sc. to resist], + and also whether these diseases have anything divine in them, + and learn how to predict them.⁷¹

It is interesting to note here that the key phrase here, ‘and also whether these diseases have anything divine in them,’ was considered suspect by editors of the text, and so placed between + marks, on the grounds that no Hippocratic would say such a thing. An interesting case of elision!⁷² In fact this passage is unproblematic, as Galen realised. He believed it referred to the atmospheres which gave rise to epidemics. That I think is generally correct, but I would also look to *On the Sacred Disease* XXI, where cold, sun and the changing winds which are never resting are reckoned to be divine.⁷³ The following passage from *On the Nature of Women* is also thought to be problematic:

The divine is most particularly a cause for human beings; next come women’s natures and complexions. Some are too pale, moister, and more prone to flux; others dark, harder, and more rigid; while those who are tanned are in between the two. The same thing is true in regard to age. The young are moister and for the most part fuller of blood, the old drier and thin-blooded, those in middle age intermediate. He who wishes to treat them correctly must first begin with the divine, then understand women’s natures and ages, and the seasons and places they are in.⁷⁴

On my view there is nothing problematic here at all. The final passage is programmatic. In order to understand women we must understand nature/the divine (which on my view are one and the same thing for the Hippocratics), then we must understand the nature of women. Understand the environment, understand the nature of man, understand the nature of women – standard Hippocratic stuff, nothing to get excited about. There is really no need for any more elaborate theory here.⁷⁵ *On Airs, Waters and Places* could be argued to go in for a form of astrology. *On Airs, Waters and Places* X say that:

And respecting the seasons, one may judge whether the year will prove sickly or healthy from the following observations:— If the appearances connected with the rising and setting stars be as they should be; if there be rains in autumn; if the winter be mild, neither very tepid nor unseasonably cold, and if in spring the rains be seasonable, and so also in summer, the year is likely to prove healthy.⁷⁶

On Airs, Waters and Places XI also tells us that:

Whoever studies and observes these things may be able to foresee most of the effects which will result from the changes of the seasons; and one ought to be particularly guarded during the greatest changes of the seasons, and neither willingly give medicines, nor apply the cautery to the belly, nor make incisions

there until ten or more days be past. Now, the greatest and most dangerous are the two solstices, and especially the summer, and also the two equinoxes, but especially the autumnal. One ought also to be guarded about the rising of the stars, especially of the Dogstar, then of Arcturus, and then the setting of the Pleiades; for diseases are especially apt to prove critical in those days, and some prove fatal, some pass off, and all others change to another form and another constitution. So it is with regard to them.⁷⁷

There is nothing problematic here though. There is no suggestion here that the heavens are in any way causative of medical conditions. Rather, the reference to the heavens is just a useful way of marking out the year. Later of course there would be medical astrology, one typical scheme had the planets with influences of hot, cold, wet or dry (or combinations thereof) affecting the humors, but we see no trace of anything like that here. *On Decorum* VI has multiple reference to the gods, but *On Decorum* is generally thought not to be a genuine Hippocratic work, there being linguistic grounds for placing it later and stylistic grounds for placing it outside the corpus.⁷⁸

Further targeting?

I have suggested that the author of *On the Sacred Disease* targeted epilepsy as a difficult and interesting case and as a key instance against the views of Homer and Hesiod that diseases are sent by the gods. I now want to investigate some other targets that the author may have in mind. As Jouanna has pointed out,⁷⁹ there are some interesting affinities in the way in which Hesiod classifies cities in *Works and Days*,⁸⁰ and the way in which the Hippocratic author of *On Airs, Waters and Places* classifies them. Both have two types of city, one where people prosper and another where they waste away, while the Hippocratic author has salubrious and insalubrious cities. In Hesiod's *Works and Days*, the aetiology is straightforward:

For those who practise violence and cruel deeds far-seeing Zeus, the son of Cronos, ordains a punishment. Often even a whole city suffers for a bad man who sins and devises presumptuous deeds, and the son of Cronos lays great trouble upon the people, famine and plague together, so that the men perish away, and their women do not bear children, and their houses become few, through the contriving of Olympian Zeus.⁸¹

On Airs, Waters and Places on the other hand has no mention of divine influence or intervention, only environmental factors. I would wholeheartedly agree with Jouanna in that:

For the poet, it is a question of the relation in each case between men and gods. For the physician, it is the relationship between men and their environment that must be taken into account.⁸²

A second important contrast which Jouanna makes is this.⁸³ What is the provenance of human skills? Are they gifts from the gods, as they are in Homer and Hesiod, or

are they something that humans have discovered for themselves? The Hippocratic *On Ancient Medicine* is quite clear on the topic:

So that the first inventors, pursuing their investigations properly, and by a suitable train of reasoning, according to the nature of man, made their discoveries, and thought the Art worthy of being ascribed to a god, as is the established belief.⁸⁴

So the discovery of medicine is a natural phenomenon for the Hippocratics. That is hardly surprising of course, but it is significant that they point that out in contrast to other views. In the *Iliad*, Asclepius is taught about drugs by Chiron, a centaur.⁸⁵ A further important point here is that *On Airs, Waters and Places* attributes barrenness in women to environmental factors where this had often been put down to the intercession of a god.⁸⁶

Van der Eijk has also made the important point that *On the Sacred Disease* not only attacks magical views and practices associated with epilepsy, it removes disease, including mental illness from religion and ethics.⁸⁷ People do not become ill, or mentally ill because they have transgressed against the gods or because they have acted immorally. They cannot be cured by making recompense to the gods or by ritual purification. If you are ill there is something natural wrong with your body, if you are mentally ill there is something natural wrong with your brain.⁸⁸ Van der Eijk says of the author of *On the Sacred Disease*:

His project to 'naturalize the mind' is related to a wider tendency of Greek thought of his time to provide natural explanations for phenomena hitherto explained by reference to divine action – not only thunder or earthquakes, but also manifestations of madness and epileptic fits. Like other Greek thinkers he is looking for the *phusis* of things and like other medical writers he is seeking the nature of man.⁸⁹

I would add here that this is also hugely important in relation to the Homeric idea that gods intervene not only in the physical world but in human mental states as well. The classic example, as we saw in the introduction to this book is Agammemnon attributing his behaviour to the intervention of a god who robbed him of his understanding.⁹⁰ We find nothing of this sort in the Hippocratics but it is widespread throughout both *Odyssey* and *Iliad*.

Meteorology in the Hippocratic corpus

One theme for this book is presocratic meteorology as a reaction to Homer and Hesiod. That meteorological phenomena are entirely natural in the Hippocratic corpus is no great surprise, but it is important to note it nevertheless. *On Airs, Waters and Places* II tells us that:

For knowing the changes of the seasons, the risings and settings of the stars, how each of them takes place, he will be able to know beforehand what sort of a year is going to ensue. Having made these investigations, and knowing beforehand the seasons, such a one must be acquainted with each particular, and must succeed

in the preservation of health, and be by no means unsuccessful in the practice of his art. And if it shall be thought that these things belong rather to meteorology, it will be admitted, on second thoughts, that astronomy contributes not a little, but a very great deal, indeed, to medicine. For with the seasons the digestive organs of men undergo a change.⁹¹

As Homer and Hesiod have rainfall as a non-natural phenomenon, it is also worth quoting *On Airs, Waters and Places* VIII on rainwater:

I will now tell how it is with respect to rain-water, and water from snow. Rain waters, then, are the lightest, the sweetest, the thinnest, and the clearest; for originally the sun raises and attracts the thinnest and lightest part of the water, as is obvious from the nature of salts; for the saltish part is left behind owing to its thickness and weight, and forms salts; but the sun attracts the thinnest part, owing to its lightness, and he abstracts this not only from the lakes, but also from the sea, and from all things which contain humidity, and there is humidity in everything; and from man himself the sun draws off the thinnest and lightest part of the juices.⁹²

So it would seem that *On Airs, Waters and Places* has an entirely natural account of the meteorological phenomena it deals with and there is no evidence that suggest any other sort of attitude in the Hippocratic corpus.

Conclusion

If we take the view that the author of *On the Sacred Disease* was a pantheist, then the view that they had an entirely natural account of epilepsy, of diseases and in all probability of all natural phenomena as well is unproblematic, as long as we are willing to accept the idea that a pantheist can have a reverence for nature. There is a certain economy to this position in that we avoid some other debates. We do not need to worry about whether the author is being polemical or metaphorical when he mentions piety and atheism as a pantheist can be pious and can attack atheism. We do not need to worry to what extent the author hides their religious views. There is no concern about the relation of science and religion. *On the Sacred Disease* has an important attack on magic in general. It targets the 'sacred disease' as an important case for natural explanation but also has further important targets, not least the naturalisation of the mind and all types of mental illness.

The Hippocratic *On Regimen*

I now want to look at another part of the Hippocratic corpus, the work *On Regimen*, including *On Regimen IV*, *On Dreams*.¹ We are again looking at a work of the late fifth century or early fourth century BCE. I am particularly interested to begin with *On Regimen I/10*, which relates anatomy to cosmology and which is generally thought to be a somewhat odd passage.² It has an interesting and often misunderstood analogy between the structure of the cosmos and the structure of the human body. In fact, it gives us a very interesting macrocosm/microcosm analogy and some of the terminology is identical to that used by the Milesian philosophers in cosmogony and cosmology. It may also help us understand the notoriously recalcitrant material on dreams in *On Regimen IV*, on which I finish this chapter.

On Regimen I/10: macrocosm/microcosm and steering fire

Let us begin with *On Regimen I/10* which tells us that:

In a word, everything was arranged (*diekosmêsato*)³ in the body by fire, in a manner suitable to itself, in imitation (*apomimêsin*) of the whole, small to large and large to small (*mikra pros megala kai megala pros mikra*). The belly is the largest, a reservoir for water dry and moist, giving to all and taking from all, with the power of the sea, nourishing creatures suited to it, killing those not suited. Water cold and moist is arranged around this, a passage for cold breath and warm breath, an imitation of the earth, which alters everything which falls to it. Consuming and increasing it scatters fine water and aethereal creative fire, the visible and the invisible, separating from that which has been set together, in which things are brought into a state of clarity, each according to its destined role. In this, fire made for itself three circuits (*periodous*) bounded by each other internally and externally. Those towards the hold of the moist have the power of the moon, while those towards the outer circuits, towards the surrounding mass, have the power of the stars and those in the middle are bound internally and externally. The hottest and strongest fire, which controls (*epikrateitai*) all things, manages

everything according to nature (*kata phusin*), it is imperceptible to sight or touch. In this are soul, mind, understanding, growth, change, diminution, separation, sleep, waking. This steers all things through all (*panta dia pantos kuberna*) both here and there and is never still.⁴

There is a great deal to discuss in this passage, but we will begin with the use of the macrocosm/microcosm analogy. While this passage does not use the full macrocosm/microcosm terminology, it should be evident that it does deploy such an analogy. The body, the microcosm, is in some way modelled on the structure of the cosmos, the macrocosm.⁵ Does this use of a macrocosm/microcosm analogy in some way undermine the integrity of this work, or give us some explanation which is not natural? There are three important points to make here based on the discussion of the macrocosm/microcosm analogy in the earlier chapter on Plato and Aristotle.

First, both Plato and Aristotle employed macrocosm/microcosm analogies as we have seen. Aristotle had the relationship between the earth's weather cycle and the motions of the heavens,⁶ while Plato had the relation between the human soul and world soul and between the heavens and the human body.⁷

Second, two millennia later, the idea of a macrocosm/microcosm analogy was still going strong and indeed was at the forefront of new thinking about anatomy and physiology. William Harvey discovered the circulation of the blood around 1619 and published *Exercises on the Motion of the Heart and Blood in Animals* in 1628. The macrocosm/microcosm analogy played a key part in how the blood flowed around the body and the two types of blood inter-converted. Harvey's view was an entirely natural one.⁸

Third, there was a wide variation of ideas on the relation of macrocosm and microcosm. So while macrocosm/microcosm analogies may involve magical ideas, they do not necessarily do so. Those of Plato, Aristotle and Harvey did not. The macrocosm/microcosm analogy of *On Regimen* I/10 may be somewhat crudely put but there is then nothing intrinsically problematic here for a naturalist reading. There is no relation between the macrocosm and the microcosm which can be construed as non-natural. There has clearly been some form of intelligent design going on such that there are meaningful similarities between macrocosm and microcosm, but this is accomplished by fire and the author is quite specific in stating that this occurs *kata phusin*.

Heraclitus and fire

That it is fire which does the controlling and steering has clear relations to Heraclitean ideas. It has long been recognised that there was a Heraclitean influence in *On Regimen*.⁹ There is the famously programmatic Fr. 30:

This *kosmos*, the same for all, was not made by Gods or men, but has always existed and will always exist. It is an everliving fire, kindling in measures and going out in measures.¹⁰

We also have Fr. 64:

The thunderbolt steers all things (*ta de panta oiakizei keraunos*).¹¹

However, the most striking similarity with a Heraclitean fragment is the closing sentence of *On Regimen* I/10:

This steers all things though all (*panta dia pantos kuberna*) both here and there and is never still.¹²

Heraclitus Fr. 41 runs:

Wisdom is one thing, to know that all things are steered through all (*kubernatai panta dia pantôn*).¹³

A final similarity with Heraclitus here is what is said about sea water:

The power of the sea, nourishing creatures suited to it, killing those not suited.¹⁴

Heraclitus Fr. 61 runs:

Sea water is both most pure and most foul, drinkable and life saving for fishes, undrinkable and deadly to humans.¹⁵

Cosmogony and cosmology

On Regimen I/10 is emphatic that fire controls (*epikrateitai*) or steers (*panta dia pantos kuberna*) everything.¹⁶ That there is a key substance which controls or steers everything is common in presocratic cosmogony and cosmology. The first sentence of this passage indicates that there is a cosmogonical sense here, as ‘everything was arranged (*diakosmesato*) in the body by fire’, while the latter part of the passage attests to an ongoing cosmological function.¹⁷ The terminology used here is familiar from the previous chapter. The term *kubernein*, to steer, is critical for Anaximander’s conception of how the cosmos comes to be from the characterless *apeiron*.¹⁸ The term *kubernein* can be found in other presocratics as well as Plato and Aristotle,¹⁹ and Plato recognised a tradition explaining the cosmos using a steering principle.²⁰ We can also find cognates of *epikratein* playing a crucial role in Anaximenes,²¹ and again there are several presocratics who have a similar use of *epikratein* and its cognates.²² Given what we have seen about how steering/controlling works for the Milesians, it is no surprise that the Hippocratic author tells us that this occurs *kata phusin*, according to nature. The author of *On Regimen* is quite fond of the *kata phusin* phrase.²³ There is another critical use of it in *On Regimen* I/9, in explaining the origins and ongoing order of humans:

Fire moved itself out of the mixture with the moist and orders (*diekosmeitai*) the body according to nature (*kata phusin*) through the following necessity.²⁴

The use of the ideas of steering and control and their *kata phusin* function is enormously important as a link between the early Greek philosophers and the Hippocratics at a quite fundamental level.²⁵ We could also add these passages to those we considered

earlier on whether all phenomena have a natural explanation for the Hippocratics. These passages are in a sense more fundamental than those we looked at though. Here we get the uniformity of nature not just implied or asserted, but built into the world view at a basic level as we do with the Milesians and Heraclitus. There is no huge gulf then between all the Hippocratics and the Milesians on these issues.²⁶ As this is the root of the idea of the uniformity of nature, it is no great surprise to find the Hippocratics attacking the idea of a non-natural origin for diseases.²⁷ Nor is it any great surprise to find the Hippocratics in *On the Sacred Disease* attacking an important and difficult case of non-natural belief and in asserting that all diseases have a natural origin, going against famous passages in Homer and Hesiod which assert the contrary.²⁸

That there is use of some form of steering function in cosmogony and cosmology is significant in explanatory terms as well. Earlier on I discussed whether the idea of pantheism, in Hankinson's phrase, was 'The Explanatory Vacuity of Pantheism'.²⁹ Here we find two very important functions. Nature is able to steer itself into a well-ordered cosmos and is able to maintain that order once it is achieved.³⁰ I take it that the view of the Hippocratic author here is that if nature did not have this steering function, we would not have our current well-ordered and stable cosmos, but would have a mess instead.³¹ Targeting here of course will be as much of an issue as it was for the Milesians, it being important to be able to give an account of the origins of the cosmos with a particular target being Hesiod's *Theogony*.

On Regimen I/12 and prophecy

On Regimen I/12 is also interesting for its discussion of *mantikê*, the art of prophecy or foresight:

I will make it clear that the visible arts are like to the characteristics of man both visible and invisible. This is foresight (*mantikê*). It knows the invisible through the visible, the visible through the invisible, the future through the present (the destined through what is), the living through the dead and through the unintelligible, understanding. The knower is always correct, the non-knower is sometimes correct and sometimes not. Foresight (*mantikê*) imitates the nature of man and life. A man by union with a woman makes a child. By the visible he gains knowledge of the unclear and what will be. The invisible human intelligence changes from child to man by gaining knowledge of the invisible. From what is he gains knowledge of what will be. The dead are not like the living, but through the dead he gains knowledge of the living. The stomach is unconscious, yet through it we are conscious of hunger and thirst. These then are the characteristics of the skill of foresight and of human nature. Those who know are always right, those who do not know are sometimes right and sometimes wrong.³²

The important thing here is that *mantikê* is treated as an entirely natural phenomenon. Predicting the course of a disease was important for Hippocratic practitioners. So *Prognostic* I begins:

It appears to me a most excellent thing for the physician to cultivate Prognosis; for by foreseeing and foretelling, in the presence of the sick, the present, the past, and the future, and explaining the omissions which patients have been guilty of, he will be the more readily believed to be acquainted with the circumstances of the sick; so that men will have confidence to intrust themselves to such a physician. And he will manage the cure best who has foreseen what is to happen from the present state of matters.³³

However, prognosis was seen by some as a form of soothsaying or magic. The Hippocratics were keen to avoid such accusations, as *On Regimen in Acute Diseases* III shows:

In this respect, they might say that the art of medicine resembles augury, since augurs hold that the same bird (omen) if seen on the left hand is good, but if on the right bad: and in divination by the inspection of entrails you will find similar differences; but certain diviners hold the very opposite of these opinions. I say, then, that this question is a most excellent one, and allied to very many others, some of the most vital importance in the Art, for that it can contribute much to the recovery of the sick, and to the preservation of health in the case of those who are well; and that it promotes the strength of those who use gymnastic exercises, and is useful to whatever one may wish to apply it.³⁴

On Regimen I/11 also has something interesting to say:

Men do not know how to investigate the invisible from the visible. Although the skills they use are like the nature of man, they do not know this. For the mind of the gods educated them to imitate what they do themselves and while they know what they do they do not know what they imitate.³⁵

I take it that 'mind of the gods' here is just a metaphorical way of saying 'nature/the divine'.³⁶ So we have a standard Hippocratic formula. Nature is capable of healing, it is the Hippocratic physician's job to learn from and to work with nature. If we take this in conjunction with *On Regimen* I/12, we learn from nature what nature's true signs are for prognosis in disease. This is the true art of *mantikê*, not what is peddled by the soothsayers. Again, there is a targeting issue here with foresight being an important phenomenon to be able to explain in a natural manner. Homer once more may be a significant target here as both *Iliad* and *Odyssey* make use of seers and foresight.³⁷ *Iliad* book one again is important here, with seers integral to the plot in three different situations.³⁸ Seers in both *Iliad* and *Odyssey* are implicated in attempting to relieve disease.³⁹ In Hesiod, early on we have a famous passage setting up Hesiod's account in the *Theogony*,⁴⁰ when the Muses appear to him and they:

Breathed into me a divine voice to celebrate things that shall be and things there were aforetime.⁴¹

If the Hippocratic authors here do come up with a redefinition and natural account of *mantikê*, that is important. According to Dodds, Xenophanes was the only presocratic to do so, though later I will argue that we need to add at least Leucippus and Democritus to this list as well.⁴²

On Regimen I/15 and natural skill

A final passage from *On Regimen I*, this time emphasising that the skill of the physician is very much in tune with nature:

Cobblers separate wholes into parts and make wholes from parts, they make sound what is unsound. Humans have the same experience. Wholes are separated into parts and from the bringing together of parts wholes come to be. By cutting and stitching, that which is unsound in men is made sound by the physician's skill. This is physicianship: to relieve pain and to make sound by taking away the problem. Nature herself knows how to accomplish these things. When sitting it is problematic to stand up, when moving it is problematic to come to rest, and in other ways nature is the same as the physician's skill.⁴³

I take the key import of this passage to be that nature in many cases (whether we construe that as the nature of humans or nature more broadly) is able to bring about healing in time. Wounds will heal and people will get better in many cases and it is the physician's job to work with nature.⁴⁴

On Regimen IV: divine dreams?

Let us now move on to considering *On Regimen IV*, also known as *On Dreams*. This is notoriously the most difficult treatise for the view that there is only natural explanation throughout the Hippocratic corpus.⁴⁵ Hankinson argues that in other works one can give a naturalistic reading to the use of terms like 'divine',⁴⁶ but:

That smooth picture is marred by a treatise on the diagnostic significance of dreams whose recalcitrance will not, I think, yield to any such interpretative strategies, Book IV of *On Regimen* (*On Dreams*).⁴⁷

I will argue that we can have a plausible natural reading of *On Regimen IV*. If that is so, we may have another interesting piece of targeting. Dreams were important for the Greeks and as we saw earlier, even Aristotle was moved to write a small piece on them. Dreams are important for Homer both in the *Iliad* and the *Odyssey*. They are there in *Iliad* book I where the seer is an interpreter of dreams,⁴⁸ but most importantly probably at the beginning of book II.⁴⁹ Throughout though there are visions and dreams sent by the gods,⁵⁰ and in the *Odyssey* Hermes leads the party through the land of dreams.⁵¹ Dreams are indisputably significant for the author of *On Regimen IV*. The first chapter begins:

Concerning the signs which come in sleep, whoever learns correctly will discover they have a major influence over all things ... whoever knows how to interpret these knows a greater part of wisdom.⁵²

The first real crux though comes when *On Regimen IV/87* tells us that:

Dreams which are divine, and foretell to cities or individuals have interpreters who are skilled in these matters. All of the bodily conditions foretold by the

soul, excess of filling or emptying, unwanted change, these they interpret too, sometimes succeeding by chance (*tungchanousi*), sometimes failing, in neither case knowing why these things come about, neither their fortunate success (*epituchosi*) nor their failure. They advise precautions to be taken against harm, but they give no teaching on how it is necessary to protect oneself, but order only prayers to the gods. To pray to the gods is good.⁵³ However, while calling on the gods it is necessary to contribute yourself.⁵⁴

There is an important matter of translation here which tells upon the author's attitude to divine dreams, interpreter's skill and their success in interpretation. This involves the verb *tungchanein*. This can mean 'to succeed' but can also have a sense of coincidence and to succeed by chance.⁵⁵ If we adopt the first alternative,⁵⁶ then one can read IV/87 as saying there are divine dreams, there are people genuinely skilled in interpreting them and they have success in interpreting them. On the second alternative, these interpreters only succeed through chance and this is a highly pejorative use of *tungchanein*.⁵⁷ One might then re-read the first sentence in this manner:

Dreams which are called 'divine', and foretell to cities or individuals have interpreters who are supposedly 'skilled' in these matters.⁵⁸

On this reading there are no divine dreams and the interpreters have no skill,⁵⁹ only having success by chance.⁶⁰ I think this makes better sense of the rhetorical structure of this passage and there are a few other considerations in favour of this reading. This is not just the only mention of divine dreams, but the only mention of the divine at all in *On Regimen* IV. The next section, *On Regimen* IV/88, seems to mark a sharp transition to an alternative account of dreams, which excludes the divine. The first line is 'Concerning these matters, this is how it is.'⁶¹ There is a parallel in Aristotle for treating the 'successful' interpretation of dreams in this manner:

They just chance to have visions resembling objective facts, their luck in these matters being merely like that of persons who play at even and odd. For the principle which is expressed in the gambler's maxim: 'If you make many throws your luck must change,' holds in their case also.⁶²

If this reading is correct, it disarms most of the non-natural critique of *On Regimen* IV, for as we shall see in a moment, other dreams have a natural provenance and can be interpreted in a natural manner.

Prophecy

There is another issue to address here though, and that is *mantikê*. As Hankinson points out,⁶³ *On Regimen* I/12 in a sense accepts *mantikê* where *On Regimen in Acute Diseases* rejects it.⁶⁴ What *On Regimen in Acute Diseases* rejects though is what the disreputable forecasters do, while what *On Regimen* I/12 accepts, or defines, is *mantikê* as a proper art, done entirely naturally taking the proper signs into account. The telling sentence is in some ways the last one:

Those who know are always right, those who do not know are sometimes right and sometimes wrong.⁶⁵

As we saw earlier, that the 'mind of the gods' is implicated in learning *mantikê* is unproblematic, if 'mind of the gods' can be given a naturalistic reading, which it can.⁶⁶ I would also see the closing sentence of *On Regimen* IV in this context:⁶⁷

I have discovered regimen, as far as it is possible for a man to discover it, with the help of the gods.⁶⁸

Here we read 'with the help of the gods' as 'with the help of nature/the divine' which brings it in line with other Hippocratic authors and the idea that medicine is discovered by humans rather than given by the gods in the traditional sense.⁶⁹ *Prorrhetic* II/2 also says that:

I, however, will not indulge in this kind of prophecy (*toiauta men ou manteu-somai*); rather I record the things on the basis of which one must estimate which men will recover and which will die ... I hope in these and other cases to make predictions which are more within human capabilities than those which are reported.⁷⁰

My proposed line of interpretation of *On Regimen* IV/87 then goes hand in hand with my proposed interpretation of *On Regimen* I/12. The author of *On Regimen* wants to naturalise *mantikê* and then give natural interpretations of dreams.

Prayer

A further issue in *On Regimen* IV is that it calls for prayer. *On Regimen* IV/89 says:

So someone who is armed with this knowledge about the heavenly signs must take precautions, and take care of regimen, and pray to the gods, in the case of the good signs to the Sun, to Zeus of the heavens, Zeus protector of the home, Athena protectress of the home, to Hermes and to Apollo, while in the case of the contrary signs to the Averters of evil, to Earth, and to the heroes in order that all difficulties may be averted.⁷¹

As Hankinson has commented, any recommendation to pray is very rare in the Hippocratic corpus.⁷² The question I would ask here is to what extent we are justified in assuming that this is intercessory or petitionary prayer rather than some other form of prayer. To offer a famous quote from Kierkegaard:

The function of prayer is not to influence God, but rather to change the nature of the one who prays.⁷³

I have nothing programmatic to say about prayer here and I do not wish to pursue a progressivist or hierarchical line about some forms of prayer being higher than others and there being a historical move to the higher forms. So, for instance, Heiler's typography of prayer recognises Greek Cultural Prayer and Philosophical Prayer as two

different types of prayer.⁷⁴ I do not want to suggest here that Greek philosophers/scientists/medics engaged in a higher form of prayer. All I want to do is suggest that there are other possibilities here than praying to deities which exist independent of nature for intervention in nature. In the introductory chapter to this book I suggested that the presocratic philosophers were quite capable of constructing their own theologies, independent of the Greek religious tradition which were entirely natural. I suggest here that philosophers and medics were capable of something similar in relation to prayer. There are many reasons one might pray, not least to seek attunement with nature/the divine. As we shall see in the next chapter, Xenophanes is an important example here as he advocates that one should pray to be able to do the right thing.⁷⁵ If there can be incorrect attitudes and actions for a pantheist, as I suggested earlier, then one might pray to achieve the correct actions and attitudes. In relation to this one might consider the final part of *On Regimen* IV/87:

To pray to the gods is good. However, while calling on the gods it is necessary to contribute yourself.⁷⁶

A further reason for recommending prayer may be the morale of the patient. The doctor's view as to whether there are gods or whether they can intervene in disease is irrelevant.⁷⁷ All that matters is that the patient believes, prays and has their morale raised which may help the doctor in effecting a cure.⁷⁸

As part of a broader issue outlined in the introduction to this book, were presocratic intellectuals capable of generating forms of prayer appropriate to their philosophical and theological beliefs? I will start with three later examples which I think are nevertheless relevant. Aristotle, in the *Nicomachean Ethics* says that:

Humans should pray that what is absolutely good is good for them, and choose the things that are good for them.⁷⁹

Given that Aristotle's god just thinks about thinking and certainly does not intervene in the world, this can hardly be a prayer for their intercession. I would suggest that it is more about our own state of mind and is tightly related to Aristotle's ethical theory. Epicurus says that:

To pray is natural for us, not because the gods would be hostile if we did not pray, but in order that, according to the understandings of beings surpassing in power and excellence, we may realize our fulfilments and social conformity with the laws.⁸⁰

Epicurus' gods have no interest in us and certainly do not intercede. Again, I suggest this is more about our own attitudes and reaching a state of happiness. Cleanthes says that:

Zeus and you, Fate, lead me
To where I have been assigned by you,
Since I will follow unhesitatingly. And if I do not wish it,
Having become an evil person, I will none the less follow.⁸¹

As a Stoic and a rigid determinist, Cleanthes can hardly be calling upon Zeus or Fate to intercede. I read this as more of a prayer about the prayer's state of mind, that they

can accept what fate has in store for them with good grace. As for the presocratics, we will see that Xenophanes prays 'to be able to achieve what is right'⁸² while Democritus prays, in a deterministic context, to meet good things and to be able to choose the good and the intellectual.⁸³ We will discuss these in more detail, but neither are best thought of as intercessory prayers, rather they focus on the state of mind of the prayer in line with the philosophy/theology of the thinker.

We might compare some Greek prayers here. It was by no means unusual to pray for a god to intercede. So at the beginning of the *Iliad*, Chryses' prayer contains the line:

Fulfil me this wish: may the Danaans pay for my tears by your arrows.⁸⁴

Or later in the *Iliad*:

Zeus, grant this wish for me. Allow us to flee and escape and do not allow the Achaeans to be beaten thus by the Trojans.⁸⁵

It was also common to make prayers concerning the dead, prayers which criticised the gods or tried to hold the gods to some form of bargain, prayers which contained curses, prayers which were related to magic. We find none of this in these alternative modes of prayer. One issue which is significant for the author of *On Regimen*, Xenophanes and Democritus is that of sacrifice. If there are gods who intercede and prayers can affect them, should there not also be sacrifices to the gods? We do not see any mention of sacrifice though at all in *On Regimen*, which might well incline us to think that prayer in *On Regimen* is not intercessory prayer. It is noticeable that sacrifice is also absent from Xenophanes and Democritus.⁸⁶

Dreams

Finally for this chapter, let us look at *On Regimen* IV and its account of how dreams come about and how they can be of diagnostic and prognostic value. *On Regimen* IV/89 says that, when dreaming:

Seeing the sun, moon, heavens and stars clear and undefiled, each in their proper order, is good. This indicates bodily health, but it is necessary to guard this state by following the current regimen. If something contrary to this occurs, this indicates some illness in the body, a strong contrast a strong illness, a weak contrast a mild illness. The stars are in the outer orbit, the sun in the middle, the moon nearest the hold. If one of the stars should appear to be disabled, or to disappear or to be obstructed in its orbit, if this is due to mist or cloud the influence is weak, but if through water or hail, stronger. It indicates that a moist and phlegmatic secretion has been generated in the body and has fallen to the outer orbit.⁸⁷

The basis here is a repeat of the macrocosm/microcosm scheme from *On Regimen* I/10. If we dream of the stars in their proper manner, this indicates the health of the corresponding circuit of the body. If we see the stars in some other way, this indicates

disease in the corresponding circuit of the body and so one with the other two circuits of the heavens and body.⁸⁸

There are various ways in which one can construe the macrocosm/microcosm relationship here. Dean-Jones suggests there is sympathy between macrocosm and microcosm.⁸⁹ That is possible, though I would in some ways, disagree with their view that:

Here the rationalist account of cause and effect has not entirely superseded the traditional belief in the sympathy of the macrocosm and microcosm.⁹⁰

In other contexts, I would argue that such sympathy can be rational but incorrect. As this book is about the non-natural, I will merely say that, as long as the sympathy relationship is invariant it is not a non-natural relationship.⁹¹ That is perfectly possible and there is no indication to the contrary here, the relation is part of nature and indeed that fire arranges everything *kata phusin* in *On Regimen* I/10 would suggest invariance. Hankinson suggests that there is a 'physical, causal relationship' between macrocosm and microcosm, without any divine mediation.⁹² That too is possible and of course would be a natural relationship. I will suggest another possibility as well, which is that there is no causal relationship between macrocosm and microcosm here. There may be no need here for anything causal between the circuits of the heavens and the circuits of the body. The issue here is whether Dean-Jones is right to assert that when we dream of the heavenly bodies 'this does not arise from the internal environment alone'.⁹³ The key to the alternative position is that 'everything was arranged (*dieko-smêsato*) in the body by fire' and that fire continues to control and steer everything (and does so *kata phusin*).⁹⁴ Our bodies are then set up such that a problem in a certain part will lead us to dream of a certain part of the heavens. The macrocosm/microcosm relationship merely describes how body and heavens have been put together. Another way of putting this is that there is correspondence but not sympathy between the macrocosm and the microcosm in this scheme. All that needs to be avoided in a naturalist interpretation here is that the relation between macrocosm and microcosm is not non-natural. There are three ways to do that. Sympathetic but natural, straightforwardly causal, or correspondence with no sympathy or causality.

On Regimen then, including *on Regimen* IV, does not present insuperable difficulties to a fully naturalistic reading. The central macrocosm/microcosm scheme can be thought of as entirely natural in three separate ways and the fact that it is organised *kata phusin* would suggest that is exactly what we should do. The analysis of dreams which depends on that macrocosm/microcosm scheme is also natural. The two key issues then are whether *On Regimen* IV/87 supposes there are divine dreams or not and what we make of the instruction to pray to the gods. One can read *On Regimen* IV/87 as rejecting the notion of the divine origin of dreams and of anyone having skill in interpreting dreams supposed to be divine. This is a viable view, making better rhetorical sense of the passage, of the fact that this is the only mention of the divine in *On Regimen* IV, of the transition to *On Regimen* IV/88 and having parallels with Aristotle's treatment of dream interpretation. Prayer can take many forms. That is so for modern day Christians as well as those in the ancient world. Are we justified in assuming that *On Regimen* IV/89 asks for intercessory or petitionary prayer? There are

many other plausible possibilities here, which do not require belief in an independent, interventionist deity.

The quality of Hippocratic theories

One question this book has posed is how good are the natural theories of the presocratics? Hankinson has this to say about their account of epilepsy:

The account sketched by the author of *The Sacred Disease* is fanciful, imperfectly supported, empirically inadequate, indeed plain wrong in just about every respect. But what matters is not the substance of the explanation but its style, which is rigorously mechanistic in form.⁹⁵

Lloyd too has been critical of both the explanation of the epilepsy and some of the basic anatomy of *On the Sacred Disease*.⁹⁶ This criticism is fair enough, as the explanation of epilepsy is speculative and some of the knowledge of anatomy is sketchy to say the least and is downright wrong in places. While I would agree with Hankinson on his criticism of the Hippocratics here, I would demur slightly on the praise. I do not think that all the Hippocratic explanations, either here or elsewhere, are 'rigorously mechanistic'. Some perhaps are, but others are going to invoke biological rather than mechanical analogues. That though is unproblematic. There is nothing about explanations based on biological analogues which will lead us to the non-natural. Biological analogues were perfectly reasonable things to use at this stage of the development of the understanding of the human body. As I suggested in the introduction to this book though, it is unwise to fixate on purely mechanistic explanations.

What might we say in favour of the Hippocratics on epilepsy though? First, that they give a self-consciously natural explanation of the disease. That opens the possibility of natural cures and as the author is quick to point out, excludes a great deal of nonsense in therapy. It is a coherent theory in that it is part of a more general explanation of the aetiology and nature of disease, one that claims to explain all disease. It covers the phenomena in explaining both the nature of epileptic fits and the nature of the affliction to the brain. The Hippocratics have experimental support for the latter having opened the head of a goat with a similar disease. There are no contemporary contenders for a better explanation of epilepsy. Theorising has to start somewhere and in some way and we might well consider exactly what we expect from the first natural theories which have no predecessors either in terms of content or methodology. One further important consideration here is that the Hippocratics clearly thought that this was a decent attempt at explanation and better than anything that had gone before it. Finally, I would disagree with Martin's assessment that:

The Hippocratic writers do not totally reject the activity of the gods, the efficacy of dreams, or other 'religious' factors *because there was no reason for them to do so*. They object to certain religious practices and beliefs, but not to religion in general or to techniques and mechanisms that *we* might think of as 'religious' or 'supernatural' or 'magical'.⁹⁷

There are religious aspects to the Hippocratics but no activity of the gods, except in the sense that nature and the divine are one. There was good reason for the Hippocratics to reject the gods as the cause of disease because this explanation did not cover the demography of the disease.⁹⁸ There are aspects of the Hippocratics which we may consider magical, but none which we should consider to be non-natural and none which the Hippocratics would have seen as non-natural. My view that the Hippocratics reject dream divination is perhaps more contentious, but one could see why the Hippocratics would reject dream divination in order to demarcate themselves and their methods from other healers in competition with them.

Conclusion

Do we find evidence of a belief in the non-natural in the Hippocratics? With *On the Sacred Disease*, I would say we do not. If we take the author to be a pantheist, then their beliefs can be entirely natural, as long as we accept the idea that a pantheist can be pious and can have a critique of atheism. With *On Regimen*, certainly one can make a plausible case that there is no non-natural belief there. The macrocosm/microcosm relationship can and indeed ought to be seen as a natural one, which then yields a natural analysis of dreams. *On Regimen* IV may have a critique of supposedly divine dreams and their interpreters, rather than being committed to the existence of divine dreams and there are many possibilities for prayer other than intercessory or petitionary prayer.

I do not claim this as a knock down refutation of any non-natural belief among the Hippocratics. I think it is highly probable that the author of *On the Sacred Disease* was a pantheist and that there is no non-natural belief here, but it is possible, though in my view unlikely, that they had a belief in an independent god or gods. I believe the pantheist view makes best sense of the evidence in the Hippocratics and gives them the most coherent position.

If they did believe in independent god/gods one would then have to consider whether the nature and actions of those gods was non-natural or not.⁹⁹ With *On Regimen*, I think the relation between macrocosm and microcosm is conclusively natural. I favour the view I have put forward on 'divine' dreams in *On Regimen* IV as I believe it makes best sense of that passage and its context, though the traditional interpretation is still a contender. With prayer, we simply do not know the author's attitude and I point out at least equally viable alternatives to the usual assumptions. I would reiterate here a point I made in the introduction to this chapter. The vast majority of the Hippocratic corpus has no evidence of any non-natural belief and the practice of the Hippocratics is very far removed from that of religious and magical healers. In this chapter we have debated the finer points of interpretation of the two treatises where some form of non-natural interpretation has been thought to be a possibility.

I have been careful here not to use arguments along the lines of 'the rest of the Hippocratic corpus clearly believes x, therefore x must be the view in this disputed passage'. One can easily see how that might be applied to *On Regimen* IV. We must

allow though that the Hippocratic corpus is diverse and there may be views in a minority of works (even a minority of one work) which disagree with the rest. That though cuts both ways. Just as we ought not to impose a spurious homogeneity on the Hippocratic corpus, nor ought we to take it that a view expressed in one work in some way infects or undermines the rest of the corpus. A second strategy I have been careful not to use is to attempt to separate *On Regimen* I–III from *On Regimen* IV on doctrinal grounds and argue the latter should not be considered Hippocratic. Whether or not *On Regimen* I–III goes together with *On Regimen* IV needs to be resolved on philological, stylistic and dating issues.¹⁰⁰

In arguing this I do not claim that ‘scientific’ or ‘rational’ or ‘secular’ medicine superseded religious medicine. First, however we categorise Hippocratic medicine, Asclepian temple medicine rose at around the same time as Hippocratic medicine and remained popular throughout antiquity.¹⁰¹ Second, I do not claim that Hippocratic medicine was secular. My view is that the Hippocratics were pantheists for whom the whole of nature was divine and regular.

I am conscious here of having focused solely on the Hippocratics. The extent to which other presocratic medical writers saw disease as an entirely natural phenomenon is difficult to judge but it is quite possible there were others. One good candidate would be Alkmaeon. Pseudo-Plutarch tells us that:

Alkmaeon held that what constitutes health is a balance of the powers, wet, hot, dry, cold, bitter, sweet and the rest. The single rule of one of them generates disease. The single rule of each is destructive. The cause of disease is an excess of hot or cold.¹⁰²

That would at least seem to give us an entirely natural aetiology of disease.

The Hippocratics, or at least the author of *On the Sacred Disease* have some interesting targets. Epilepsy is clearly an important and interesting case for natural explanation against a background of non-natural belief including Homer and Hesiod. Their approach is broader than this though and encompasses all types of mental illness and naturalisation of the mind. It also seems that the natural origins of medicine are a theme in the Hippocratic corpus and that *Airs Waters Places* targets Hesiod in its account of cities and diseases. *On the Sacred Disease* is also important for its general attack on magic, not just on individual incompetent magical practitioners. *On Regimen* has its interesting targets as well. It is important to be able to give a natural account of the provenance and interpretation of dreams and a natural account of foresight which defines a proper role for prognosis. Homer may once more be an important target here as seers and god-sent dreams play a significant role in his works, particularly in the first two books of the *Iliad*. The cosmogony of *On Regimen* I/10 may also target Hesiod’s *Theogony* in parallel with the Milesians.

One thing this chapter has thrown up is some closer affinities between the Hippocratics and the presocratic philosophers. Targeting of non-natural beliefs is important as is the more general naturalisation brief. I think also of great importance are the notions of pantheism and that pantheism is not vacuous in explanatory terms for the Hippocratics. The strong version of this comes in *On Regimen* I/10 with uses of *kubernein* and *epikratein* and cognates to describe how matter steers or organises

itself naturally into a cosmos. Here the language is identical with that of Anaximander and Anaximenes and both Hippocratics and Milesians believe nature to be divine in some sense. The weaker version is that the Hippocratics see the cosmos as not only well ordered, but morally and aesthetically good, enabling them to treat it as an object of reverence and, critically, piety. The Hippocratics were better integrated into contemporary cosmogony and cosmology than is usually supposed. In relation to the Hippocratic conception of the cosmos, Vlastos' famous comment on the Ionians and the Hippocratics is probably overly harsh. He says that:

Why use at all the term divine? The answer is to be found in the well-established practice of Ionian rationalism to salvage religious terms so long as: (a) they can be adapted to the exigencies of naturalistic logic; and (b) they do not inhibit rationalist criticism of magic. So, for example, the Hippocratean treatises: Call the sacred (or any other) disease divine, if you will, but (a) understand its natural cause; and (b) do not let religious symbols deliver you into the hands of the magicians, purifiers, charlatans, and quacks who practice under religious auspices. That is how Democritus appears to treat the term divine.¹⁰³

My objection here is that if we treat the term 'divine' in this way for the Hippocratics (and indeed for the Ionians), we are likely to miss the crucial explanatory importance it has for them. It is not just a name for a disease or for nature, it signifies something important for them about the nature of the world.

One recent shift in the historiography of Hippocratic medicine, and indeed ancient medicine in general is an increasing willingness to accept religious elements as coexistent with what have previously been seen to be separate rational or scientific elements.¹⁰⁴ The notion that the author of *On the Sacred Disease* and *On Regimen* were pantheists sits well with this new move.

The great majority of the Hippocratic corpus displays no belief in anything non-natural. How much that is the case for presocratic medicine outside the Hippocratic corpus is a question I have not had space here for. I have argued that *On the Sacred Disease* does not have any non-natural belief. I have made a case that *On Regimen*, both I–III and IV has no non-natural belief. As I said in the introduction to this chapter though, the point is not so much whether every work in the Hippocratic corpus rejects the non-natural, but that a large majority of them do so.

Xenophanes and Others: More Natural Explanation

In this chapter, I want to look at some more examples of supposed naturalism and targeting of non-natural explanations. Some of the names and themes here will be no great surprise: Xenophanes (c. 570–c. 475 BCE) and his criticism of Homer and Hesiod on the gods, Heraclitus (c. 535–c. 475 BCE) on criticism of rituals and emphasis on an orderly cosmos, Anaxagoras (c. 510–c. 428 BCE) on the natural explanation of phenomena. Some of the themes for these philosophers though may be a little more out of the ordinary. Xenophanes on St. Elmo's fire, meteorological phenomena, divination and prayer, Heraclitus on divination, Anaxagoras on an experiment to explain why a ram had only one horn. Some names would not be found in a standard history of presocratic philosopher, but their views on the non-natural are still important and show a broader rejection of non-natural thinking than just some presocratic philosophers and medics. So I want to look at the way in which the author of the Derveni papyrus tries to understand Orphic theogony in a naturalist manner, at how Thucydides (c. 460–c. 395 BCE) treated the Athenian plague and other phenomena and at how Aristophanes (c. 446–c. 386 BCE) portrayed the critique of the non-natural in his plays, especially as he used meteorological phenomena in his depiction of philosophers. This is important in trying to assess just how large a group of presocratics rejected the non-natural. Philosophers were of course important in this, but were not the only group of people involved. If this book was a survey of presocratic philosophy, some of the characters in this chapter would have chapters of their own, most prominently Heraclitus and Anaxagoras.¹ Here though I am concerned with interesting attempts at natural explanation and interesting rejections of non-natural explanation so we have a different selection of material.²

Xenophanes and negative theology

Xenophanes (c. 570–c. 475 BCE) was an important figure in the development of philosophical theology and it is coming to be appreciated that he was an important figure in the *periphrasis* tradition as well.³ Fragments 11, 14, 15 and 16 are usually strung together in this order as Xenophanes' critique of contemporary theology:⁴

Homer and Hesiod have ascribed to the gods all those things which are shameful and reproachful among men: theft, adultery and deceiving each other.⁵

Mortals believe that the gods are born, and that they have clothes, speech and bodies similar to their own.⁶

If cattle, horses and lions had hands, and could draw with those hands and accomplish the works of men, horses would draw the forms of gods as like horses, and cattle like cattle, and each would make their bodies as each had themselves.⁷

The Ethiopians claim their gods are snub-nosed and black, while the Thracians claim theirs have blue eyes and red hair.⁸

Fragments 14, 15 and 16 give us Xenophanes' well-known critique on anthropomorphic theology. Mortals believe the gods to be like themselves, animals would have gods similar to themselves, other human cultures envisage the gods as similar to themselves. Homer and Hesiod suppose the gods to have the moral fallibility of humans. Fragment 11 is of course important to me because here we have a direct, named attack on Homer and Hesiod. The passage comes from Sextus Empiricus. Who also gives us fragment 12, which has Homer and Hesiod singing of 'theft, adultery and deceiving each other'. Sextus cites Kronos castrating his father and swallowing his children, and then Zeus usurping Kronos and throwing him under the earth as an example of poor behaviour by the gods in Homer.⁹ I will be arguing that there are other attacks on Homer and Hesiod in Xenophanes and also that he takes on an interesting, supposed non-natural phenomenon mentioned by neither Homer nor Hesiod. Fragment 14 may also be directed at Homer and Hesiod as both believe the gods to have been born, indeed that is a major theme of Hesiod's *Theogony*.¹⁰ Another passage that may be directed at both Homer and Hesiod is in Xenophanes Fragment 1:

Do not speak of Titans or Giants or Centaurs, fictions of old, or furious battles. In these there is nothing useful.¹¹

Xenophanes and the cosmos

We know little of what Xenophanes had to say about cosmogony and cosmology, but what we do know would seem to indicate that he was a naturalist. Xenophanes Fr. 29 tells us that:

All things that are generated and grow are earth and water¹²

Fragment 33 also indicates that humans are to be included in this:

We were all generated from earth and water.¹³

Fragment 27 gives us:

Everything comes from earth and everything will end as earth.¹⁴

The following piece of cosmology is a little crude in having an unlimited earth and a sun which is new every day, but there is no sense that the new sun is generated by any deity. Hippolytus tells us that for Xenophanes:

The sun is generated each day from small pieces of fire, the earth is unlimited and is not surrounded either by air or the heavens. There are unlimited suns and moons, and all things come from earth.¹⁵

It is also significant that for Xenophanes, particularly in relation to the natural provenance of clouds, that the stars are generated from clouds, and are extinguished at setting and kindle at rising, and that the moon is compressed cloud.¹⁶ We also learn from Hippolytus that:

Mankind is destroyed when earth is carried down into the sea and mud is generated, then another beginning is generated, and this foundation occurs for all of the cosmoi.¹⁷

It is unlikely that the earth as such is destroyed here. More likely there is a sufficient catastrophe for humans, and perhaps all life to be wiped out, when life is again generated from earth and water. So we should take cosmoi in the Hippolytus passage to refer to a human order which is destroyed in each deluge, especially as Pseudo-Plutarch also tells us that:

Xenophanes says that the cosmos is ungenerated, eternal and imperishable.¹⁸

It is likely then that Xenophanes held some form of cyclical theory concerning land becoming sea or mud, and this eventually becoming land again, perhaps with the destruction of humans in each cycle.

St. Elmo's fire

There is a phenomenon which was well known in the days of sailing ships, known as St. Elmo's fire. It is caused by the build up of electrical potential in the atmosphere. When the potential becomes great enough, there is a discharge between the air and objects in it, typically to pointed objects.¹⁹ In sailing ships, this manifests itself as a glowing at the tops of masts or the ends of cross members on masts. This glowing is coloured blue or violet and the discharge can also make a noise, typically a crackling sound. There is a marvellous description of this phenomenon in Melville's *Moby Dick*,²⁰ which also attests to the commonly held belief that this was a supernatural phenomenon.²¹ In terms of targeting, this is a difficult and interesting phenomenon to give a natural explanation of. Xenophanes is undaunted though and we can find his view in both Stobaeus and Pseudo-Plutarch:

Xenophanes held that concerning the star-like phenomena on ships, which are called by some Dioskouri, they are small clouds which glimmer due to a certain kind of movement.²²

The Dioskouri were divine twins who were considered to be helpful to travellers in general and to sailors in particular. The association between the Dioskouri and St. Elmo's fire is now reckoned to be early, around the seventh or sixth century BCE.²³ There can be no doubt that at the time Xenophanes wrote, St. Elmo's fire was considered by many to be a non-natural phenomenon or that Xenophanes was attempting to give a natural explanation of this phenomenon. This explanation is entirely in line with the general scheme of Xenophanes' physics, which Mourelatos has termed 'cloud astrophysics'.²⁴ Xenophanes is very keen on explaining everything in terms of clouds, which in turn he considers to be an entirely natural phenomenon. That in itself is interesting, as one of the standard epithets for Zeus in Homer is that of 'the cloud gatherer'.²⁵ In this context it is notable that Fr. 10 runs:

Since the beginning, all have learnt from Homer.²⁶

One might speculate that this is programmatic, especially in relation to Fr. 11. Everyone has learnt from Homer, but Homer is not teaching us what is right. With Xenophanes' positive theology and with what he has to say on nature, which also seems to be aimed at Homer, we can perhaps have some new and better teaching. In that context, Fr. 18 may be important:

The gods did not reveal all things to mortals from the start but through time, by seeking, they will find out better.²⁷

Xenophanes and meteorology

One theme for this book is that Anaximander explained meteorological phenomena in natural terms in direct opposition to Hesiod and that there was a presocratic tradition of naturalising meteorological phenomena. Where does Xenophanes fit into this? Let us begin with one of the staple phenomena, lightning. Xenophanes says that:

Lightning occurs when clouds become bright due to motion.²⁸

We have also seen Anaximenes attempt to explain the rainbow in natural terms,²⁹ and that it had non-natural connotations for Homer and Hesiod.³⁰ Xenophanes says that:

What is called Iris is also a cloud, red, purple and greenish yellow to see.³¹

So again the rainbow is an entirely natural phenomenon. It is notable in this context that, as Dodds has pointed out,³² Cicero in *On Divination* picks out Xenophanes as someone who denied the validity of divination,³³ as both St. Elmo's fire and the rainbow were traditionally seen as portents. Mourelatos has suggested that *iris* here refers to a broader range of phenomena than just rainbows, such as halos, caronae, parhelia and cloud iridescence. This is helpful in several ways. An *iris* can then precede a storm, unlike rainbows which usually follow a storm. It is more plausible to think of a rainbow as a cloud if it is a type of *iris* and all types are clouds. This makes the 'rainbow' theory considerably more powerful and more general if it is taking in all of the *iris* phenomena here.

Leshner also makes an interesting point about the closing words of this line.³⁴ Homer often finished lines with 'marvellous to see', with the gods being implicated in why this was marvellous. Here Xenophanes finishes his line with the same 'to see' but with simply the colours and no 'marvellous' and nothing about the gods. As Leshner comments, those used to the rhythm and content of Homer would appreciate the difference here with Xenophanes. Lloyd has commented that we should be careful in assuming that every Greek saw the rainbow as a portent.³⁵ I would agree, but clearly some presocratics, and in Homer and Hesiod some influential presocratics did see the rainbow as a portent. Lloyd recognises the possibility of Xenophanes' theory being an implicit rejection of the rainbow as a portent, but says:

If that *may have* been thrust of Xenophanes' point, that is just conjecture on our part.³⁶

Lloyd generalises this to 'other such ideas attributed to the early philosophers'.³⁷ I disagree in this case, where I believe we have good grounds for believing that Xenophanes is targeting non-natural explanations. I disagree in general. We have seen several particular cases where non-natural explanations are targeted. If the targeting thesis I develop throughout this book is correct, then it is more than just conjecture that other presocratic thinkers do not merely give natural explanations, they take on important or difficult-to-explain phenomena which had been explained non-naturally and target famous passage in Homer and Hesiod as well.

With the cloud astrophysics theory, we might of course question where the clouds come from and Xenophanes tells us that:

The sea is the source of water and the source of winds,³⁸ without the great sea there could be neither the flowing rivers nor the rainy waters of the sky, but the great sea is the generator of clouds, winds and rivers.³⁹

So unsurprisingly clouds are an entirely natural phenomenon as well. Mourelatos has pointed out Xenophanes also has some interesting things to say about the sun:⁴⁰

The sun which soars and heats the earth.⁴¹

An ancient source for this fragment discerned an association with Homer here. The Greek for 'soar' here is *huperiemenos*, and the personification of the sun in Homer is Hyperion.⁴² Again it is noticeable that this comes in an important, memorable passage, the first book of the *Odyssey*. One can also find Hyperion associated with the sun in Hesiod.⁴³ Is this another naturalisation aimed at Homer and Hesiod, the sun warms the earth because it soars above us but not because it is Hyperion? We also have:

Xenophanes held that the sun contributes to the origin and administration of the cosmos and all the living things in it, while the moon is redundant.⁴⁴

Why this disparity between the sun and the moon? Mourelatos suggests that the sun still has the power to warm, even if we take away the association with Hyperion. However, the moon does little in physical or natural terms that we can perceive. Take away the personification of Selene, associated with menstruation and pregnancy (or whatever god you associate with the moon), then the moon has negligible power compared with what the sun does.⁴⁵

Xenophanes and divination

Cicero is somewhat blunt on Xenophanes' views on divination:

Certain carefully worked out arguments of the philosophers for the reality of divination have been collected; among these, to speak of the earliest, Xenophanes of Colophon, one who said that the gods existed, repudiated divination in its entirety. The remainder, except really only Epicurus who spoke rather obscurely about the nature of the gods, approved of divination.⁴⁶

Pseudo-Plutarch also tells us that:

Xenophanes and Epicurus did away completely with divination.⁴⁷

We do not have anything directly from Xenophanes to back this up, but given the way that he treats many other phenomena naturalistically this seems highly plausible. The strong way to read this is that Xenophanes simply denied the veracity of any form of divination, rather than tried to give a natural explanation for divination and deny any non-natural divination. Given the evidence we have that is possible but by no means certain.

Metempsychosis

Xenophanes has something to say about Pythagoras and the idea of metempsychosis, something we will look at in greater detail in the chapter on Pythagoras.

On the subject of reincarnation, Xenophanes tells a tale which begins: Now I turn to another account and I will show the way. He says this about Pythagoras: Once he passed a young dog which was being mistreated, and taking pity he said: 'Stop, do not beat it, that is the soul of a man who was my friend, I recognised it when it cried aloud.'⁴⁸

There is a general consensus that this passage is mocking in its tone and that Xenophanes considers there to be something ridiculous here.⁴⁹ Most think this is the idea of metempsychosis in general, Leshner makes a case that it is the idea that Pythagoras could recognise the soul of a friend in a dog's bark.⁵⁰ I favour the first view here, though Leshner's view remains a possibility. Certainly Plato entertains the transmigration of souls so perhaps that idea is not ridiculous in itself, but we might ask whether metempsychosis/transmigration makes any sense within Xenophanes' conception of theology or the soul, as far as we can reconstruct those ideas. I would suggest it does not and with that context this is a general mocking of metempsychosis.

Natural/pantheist god for Xenophanes?

Any case against Xenophanes rejecting the non-natural entirely will have to base itself on the fact that Xenophanes recognised some form of deity. So for Xenophanes, in Fragment 23 there is:

One God, greatest among Gods and men, entirely dissimilar to mortals in *nous* and body.⁵¹

I take Xenophanes to be a monotheist, despite the phrase 'greatest among Gods and men' in fragment 23. This phrase is emphatic or formulaic rather than asserting many gods of which one is supreme.⁵² One might compare Heraclitus Fr. 30, 'This cosmos, the same for all, was not made by Gods or men.' Against this view two points are commonly made. First, Xenophanes attacks Homer, Hesiod and others on the nature of the gods but not on numbers of gods. That hardly seems conclusive though, as we may not have all of Xenophanes' criticisms and a strong monotheist might think that monotheism is implicit in these criticisms anyway. The second point is that while we might not be concerned about the reference to gods in the plural in fragment 23, we should be at the close of fragment 1, line 24:

It is always good to hold gods in high regard.⁵³

It is argued that this is the climax of a piece on piety and good behaviour so this must be serious.⁵⁴ There is also the consideration that why would a monotheist, in a polytheistic society, say something so loose and open to misinterpretation?⁵⁵ I would question the nature of fragment 1 though. Is it a work of philosophy or theology? If it were, I would be concerned about these objections to monotheism. An alternative is that fragment 1 is an outline for a religious meeting at a house with an ending which is inclusive for all those who attend,⁵⁶ whether they believe in one god or many.⁵⁷ I would suggest the emphasis of fragment 1 is on good behaviour (13–16 on praying to do right) and on generous behaviour (1–12 on setting out the house and table) rather than on how many gods anyone participating might believe in. Even in line 24, one might reckon the emphasis is not on the number of gods but on holding them in high regard, unlike those who attribute 'theft, adultery and deceiving each other' to them. As a philosophical/theological work fragment 1 might be held to be contradictory on the number of gods anyway. At line 13, men sing to a single god, while at line 24 they hold gods in high regard.

A possible modern parallel. In the 1970s and 1980s there was a comedian called Dave Allen who had his own TV show in Britain and Ireland. Allen was an atheist who told many jokes mocking religion, most notoriously about Catholicism.⁵⁸ An immensely amiable and good humoured man, he would always end his show with:

Thank you, goodnight and may your God go with you.

Should an atheist say that? A good-humoured, generous atheist who does not believe but is not bothered if other people do believe might well do as an inclusive gesture of good will. If Xenophanes were generous and good natured (and I think fragment 1 suggests both) he might well end on something generous and inclusive.⁵⁹

That there is a single god fits much better with the rest of Xenophanes' fragments. The notion of a single god, with none of the human vices will be important for Plato's cosmogony and much subsequent cosmogony.⁶⁰ It is notable that Plato is not worried about referring to gods in the plural. What of the nature of Xenophanes' god though? Aristotle tells us that:

Xenophanes, the first of those who declare all is one (for Parmenides is said to have been his pupil), made nothing clear, nor does he appear to have grasped at the nature of either of these causes [i.e. the unity being definable with respect to either the material substrate or formal criteria], but, considering the whole heaven, he declares that the One is the god.⁶¹

That too would seem to indicate a single god, unless Aristotle has radically misunderstood Xenophanes. Aristotle's report would seem to imply some form of pantheism. One view here, based on Aristotle and the later doxographic tradition is that the universe is spherical for Xenophanes and that god is identical with it. However, as Xenophanes has the asymmetry of the earth extending downwards without limit, a spherical universe looks inappropriate.⁶² There are difficulties too with the identification of god with the universe, whatever shape the universe may be. The problem is fragments 25 and 26 taken together. In fragment 25 this god for Xenophanes is:

Entirely without effort he agitates (*kradainai*) all things by the thought of his mind.⁶³

While in fragment 26, god

Always he remains on one place, not moving, nor is it proper to go to other places at other times.⁶⁴

If we take fragment 25 in a pantheist manner such that god moves himself, that appears to contradict the non-moving nature of god in fragment 26. One possibility here is that we take fragment 25 as purely *ad hominem* against Homer, who has Zeus shake Olympus with a nod or by sitting.⁶⁵ Here Xenophanes' god shakes everything with no physical effort at all. If that is the focus, perhaps we should not take fragment 25 to have any cosmological import. A second possibility is that god sets everything in motion, perhaps looking to the attested sense of *kradainai* as setting a bell ringing and we interpret that as a rotation of the heavens.⁶⁶ In fragment 26, we take the ban to be on motion from one place to another, rather than rotating in the same place.⁶⁷ A small retreat from the full pantheist position would be to have god co-extensive with the universe where the god does not move but the universe does. An alternative view is that suggested by Trepanier, that the relation of god and world for Xenophanes is akin to that between mind and body, with Plato in the *Timaeus* or Anaxagoras with *nous* as possible later parallels.⁶⁸

Whether Xenophanes was a pantheist or not, the real question for us is whether his conception of god is in any way non-natural. To that I think the answer is clearly no. Xenophanes' god has a nature of its own and is unchanging and so is invariant. Xenophanes' god clearly does not intervene in the world, even if it is to be conceived as in some way separate from the world. Xenophanes' god seems to be conceived very much as the antithesis of the sort of god we find in Homer and Hesiod.

Xenophanes and prayer

Xenophanes Fragment 1 has something very interesting to say. It runs through how properly to set house and table and then says:

Having poured a libation and prayed to be able to achieve what is right.⁶⁹

Several commentators have commented on what they perceive as the novelty of this prayer.⁷⁰ It is not a prayer for success or for the intervention of some god, but a prayer that one will be able to achieve what is right. This is enormously important for two reasons, which relate in particular to the Hippocratics but are important for the presocratics in general. This is not an intercessory or petitionary prayer, asking for a god to intervene, but a prayer to have the ability to do right. We cannot assume then that all prayers were intercessory or petitionary. Second, there is an issue of piety here. The prayer wishes to be able to do what is correct. If Xenophanes is a pantheist, then a pantheist can be pious and can pray. In relation to the previous chapter and the interpretation of *On the Sacred Disease* and *On Regimen*, the pantheist author of *On the Sacred Disease* can be pious, and the pantheist author of *On Regimen* can call for prayer without that necessarily being intercessory or petitionary prayer. It is also noticeable that there is nothing about sacrifice either here or anywhere else in Xenophanes. True, there is the pouring of a libation, but that is a different matter from sacrifice and might be done for a variety of reasons, not least to honour a god or gods. As libations were poured at sacrifices, the lack of any mention of sacrifice is all the more notable here.

There is some question of the scope of what is being prayed for here. The minimal view is that the prayer is for doing right on this occasion or whether it is for doing right more generally. I see no reason for restricting this to doing right in terms of setting the house and table properly, especially as the previous line runs:

First it is necessary that gracious men should sing to the gods with auspicious (*euphêmois*) tales and pure words.⁷¹

euphêmois here could also be translated as 'pious'. One more general point I would take out of this is that not only could presocratic intellectuals devise their own theologies apart from the Greek religious tradition, they could devise their own means of prayer and notions of piety as well, entirely in accord with their naturalistic theologies.

Good natural theories?

To return to the question of whether presocratic natural theories were any good, Xenophanes has had something of a bad press but attitudes more recently have been much more positive. Guthrie comments that:

In these physical matters Xenophanes does not seem to have been bothering his head very much. Anaximenes could certainly have taught him a more sophisticated explanation of the rainbow.⁷²

This, given recent work by Leshner and Mourelatos now looks rather outdated.⁷³ One question would certainly be what is more sophisticated about Anaximenes' account. More in line with how we understand the rainbow perhaps, but that does not in itself entail greater sophistication. Lloyd has commented on Xenophanes' rainbow theory that it:

Does not seem to have been a particularly inspired suggestion, even if we make allowances for Xenophanes as a very early debut natural scientist: it is not even as if a rainbow obviously resembles a cloud.⁷⁴

Mourelatos' suggestion that *iris* here refers to a broader range of phenomena than just rainbows which we looked at earlier would seem to counter this view very effectively though, as well as explaining why we see this sort of phenomenon before as well as after storms. The merits of Xenophanes are his simplicity, breadth and coherence of explanation. As Mourelatos has termed it, he has a 'cloud-astro-physics',⁷⁵ and he explains a great number of phenomena in terms of what clouds can do, while having a natural explanation of the origin of clouds. Mourelatos also argues that what he terms the 'X is really Y pattern', e.g. a rainbow is really a cloud is an important early example of reductive thought.⁷⁶ Xenophanes is also bold in his assault on phenomena which were perceived to be non-natural as can be seen in his attempt to explain St. Elmo's fire in a natural manner. He is also broad in his dismissal of non-natural phenomena, particularly at the end of Fragment 1 where he dismisses talk of 'Titans or Giants or Centaurs' as 'fictions of old' and having no value.

Heraclitus

Heraclitus (c. 544–484 BCE) did not have a cosmogony, and believed the cosmos to be eternal.⁷⁷ A key passage for the idea that Heraclitus rejected non-natural and divine intervention is fragment 30:

This cosmos, the same for all,⁷⁸ was not made by Gods or men, but has always existed and will always exist. It is an everliving fire, kindling in measures and going out in measures.⁷⁹

Here 'Gods or men' is taken to be a polar expression meaning 'no-one at all' rather than asserting the existence of gods.⁸⁰ We can read cosmos as 'ordered universe' or possibly just as 'underlying order'. Whichever way we read this, the order is underpinned by fire kindling and going out in measure which strongly suggests invariant behaviour. This is a remarkably blunt and forthright passage, in that it rejects the Milesian ideas of how a cosmos came into being and rejects any notion that the gods generated the cosmos. That fire can change into other things in an orderly manner can be taken from Heraclitus Fr. 90:

All things are an equal exchange for fire and fire for all things, as property is for gold and gold is for property.⁸¹

We might note this thought on the equal exchange at a cosmic level and compare with the Theognis passage we looked at in relation to Anaximander and the Anaximander extant fragment.⁸² Heraclitus on the *logos* which might be translated either as word or account in fragment 1 would also seem to indicate a world with invariant behaviour:

Though this Word is true evermore, yet men are as unable to understand it when they hear it for the first time as before they have heard it at all. For, though all things come to pass in accordance with this Word, men seem as if they had no experience of them, when they make trial of words and deeds such as I set forth, dividing each thing according to its kind and showing how it is what it is. But other men know not what they are doing when awake, even as they forget what they do in sleep.⁸³

In relation to the theme of *logos* and being awake, Heraclitus Fr. 89 tells us that:

For those who are awake the cosmos is one and common, but those who sleep turn away each into a private world. We should not speak and act like sleeping men.⁸⁴

That is very interesting in effectively asserting an independent and objective reality for humans, if they are awake. Given the importance of dreams and dream prophecy in Homer, Hesiod and Greek culture generally, it is then significant that Heraclitus rejects these private worlds of sleep. Is this a rejection of dream divination as well? If so that is important. Dodds has asserted that only Xenophanes rejected divination,⁸⁵ I have suggested that the Hippocratics do in a sense as well.

Heraclitus and meteorology

Heraclitus has natural explanations for meteorological phenomena. It is significant to note that he has explanations for all five of the phenomena that Anaximander dealt with and which we found in a famous short passage in Hesiod. Let us start with the thunderbolt and Heraclitus Fr. 64:

The thunderbolt steers all things.⁸⁶

We might take the notion of steering here to indicate invariant behaviour as well, especially as Heraclitus Fr. 41 tells us that:

All things are steered through all.⁸⁷

While we have a different verb for steering in Fr. 64, we are back with our old friend *kubernēin* in Fr. 41, familiar from Anaximander and the Hippocratic *On Regimen*. That all things are steered would seem to indicate invariance and that the thunderbolt is drawn into this as well, when the thunderbolt is the well-known instrument of Zeus in Homer, and Hesiod is significant as well. We can also find reference to the hurricane in Heraclitus Fr. 31:

The changes of fire: first, sea and then of sea, half becomes earth and half becomes the hurricane (*prêstêr*).⁸⁸

We also have this from Stobaeus:

According to Heraclitus, thunder (*brontê*) is due to the twisting together of winds and clouds and the collision of winds in the clouds lightning (*astrapê*) to the kindling of burning, hurricanes (*prêstêr*) are due to the burning and quenching of clouds.⁸⁹

That gives us thunder, lightning and the hurricane again. True, we do not have a by name reference to typhoons, but we do have winds and the origin here is Hesiod's reference to Typhoeus, the god of winds. So we have all five phenomena contested between Hesiod and Anaximander and Heraclitus gives natural explanations for all of them.

Critique of religion

Heraclitus is well known for his vitriolic critique of some contemporary religious practices. Fr. 14 says that:

With night-walkers, magicians, bacchantes, revelers, and participants in the mysteries. What are regarded as mysteries among men are unholy rituals.⁹⁰

Fragment 5 is also highly critical:

They cleanse themselves with others' blood, as if someone were to wash himself by walking in muck were to cleanse himself with muck. It would seem madness to observe such a man who is acting this way. And they pray to images, much as if they were talking to temple edifices, for they do not know what gods and heroes are.⁹¹

That Heraclitus was some form of pantheist is generally recognised. A key passage in this regard is fragment 67:

God is day and night, winter and summer, war and peace, surfeit and hunger; but he takes various shapes, just as fire, when it is mingled with spices, is named according to the savor of each.⁹²

One might add to that Fr. 41 and the idea that all things are steered through all. I would agree with KRS when they say that 'God here cannot be essentially different from Logos.'⁹³ Within this general context of invariance and measure, we ought to look at Heraclitus Fr. 94:

The sun will not overstep his measures. If he does, the Erinyes, the defenders of justice, will find him out.⁹⁴

Does this commit Heraclitus to the existence of the Erinyes? Heraclitus is operating here with a civil law conception of physical behaviour, rather than a mathematical law conception. Within civil law, breaches of the law are conceptually possible and are met with punishment, while in the mathematical law conception breaches are

conceptually impossible.⁹⁵ However, it is possible to have civil law conceptions of physical behaviour where breaches are conceptually possible to do not actually happen. Plato on astronomy, where the good souls of the heavenly bodies always act in an entirely regular manner is a good example of this.⁹⁶ Given the structure of the world for Heraclitus and the emphasis on measure and *logos*, I do not think the sun will overstep his measures. The reference to the Erinyes then is metaphorical rather than existential. Heraclitus in fragment 78 does say that:

It is not the part of humans to have true judgement, but divine nature does.⁹⁷

Throughout Heraclitus there is a strong contrast between humans and the divine.⁹⁸ If we equate god = divine = *logos* though that is no great surprise. This does not establish an omniscient divinity apart from nature.

Heraclitus and eschatology?

Heraclitus' comments on the fate of the soul are very fragmentary and it is difficult to come to any precise position on them. That the soul is associated with fire is clear enough, as is the idea that the soul can die by becoming moist.⁹⁹ This places the soul very much within the natural realm for Heraclitus and there is no indication that the soul goes to some other, non-natural world after the death of the body. Whether the soul can survive the death of the body and for how long are disputed points. That 'Better deaths gain better portions' might suggest some sort of continuing life for the soul,¹⁰⁰ but as the soul would still be fire and part of the cosmos it is doubtful if this is immortality.

The Derveni papyrus

The Derveni papyrus was found in 1962 and although only partially legible, it provides a very interesting addition to our knowledge of the presocratics. What we have of the Derveni papyrus is both fragmentary and complex. We have 26 sections, none of them complete, ranging from a few words to a few paragraphs. I do not propose to try to give a definitive interpretation here, as that would be the work of another book.¹⁰¹ What I do want to do is to try to pick out a few themes in the Derveni papyrus which have been discussed in this book. I believe there to be some targeting, in that the author of the Derveni papyrus attempts to give a naturalistic interpretation of an Orphic theogony. I also believe there to be some interesting references to Heraclitus, which suggest similar views on cosmic order and dreams, and some interesting parallels to the Hippocratic critique of magic. The author follows an exegetical strategy which was common in relation to understanding Homer from an early stage. The Homeric gods were understood to be representative of the entities or the phenomena of the cosmos, such as the elements or winds or earthquakes.

Targeting?

The author of the Derveni papyrus says this about the Orphic material they are dealing with:

His poetry is something strange and riddling for people. But Orpheus did not intend to tell them capritious riddles, but momentous things in riddles.¹⁰²

In saying that she is nurse, he expresses in a riddle that whatever the sun dissolves through heating the night sets together by cooling.¹⁰³

The Derveni author sets out to dissolve the Orphic riddles and give a cosmogony and cosmology in the manner of the presocratic philosophers.¹⁰⁴ In the Orphic material, there is a succession of ruling deities. First there is Ouranos, son of night,¹⁰⁵ then there is Kronos,¹⁰⁶ and then there is Zeus.¹⁰⁷ From the primordial domination of darkness and coolness, we then have the activity of the domination of fire in the reign of Kronos followed by the cosmic ordering under Zeus. The Derveni author sees these not as independent deities, but personifications of the state of order in the developing cosmos.¹⁰⁸ Column 19 tells us that:

Existing things have each been called a single name on account of what dominates them, all things being called Zeus for this reason. Air dominates all as far as it wants to. When they say that Moira span they say that the understanding of Zeus sanctions how the things that are, that have been generated and the things that will be must come to be and cease. He likens him to a king (for this appeared to him the most appropriate of all the names that are said), saying this: 'Zeus the king, Zeus the ruler of all with the shining thunderbolt.' He said he is king because of many ... One rule dominates and accomplishes all.¹⁰⁹

There is no absolute coming to be in the cosmogony and cosmology of the Derveni papyrus. The author frequently contrasts 'the things which exist' and 'the things which exist now' and makes it entirely clear that the things which exist now have come into being from the things which have always existed and are composite entities.¹¹⁰ In the pre-cosmic state fire dominated and prevented things from being set together, disordering them due to its heat.¹¹¹ The cosmic intelligence then removes fire to a safe distance, so that things can begin to separate out. The sun is generated by being 'separated and encircled' and the things above and below the sun then solidify and separate out.¹¹² In the Orphic poem there is a good deal of sexual imagery concerning the sun, the gods and the transition from one phase of the cosmos to another.¹¹³ The Derveni author sees an association between the generative organs and generation and sees this as a symbolic way of representing the changes of the cosmos.¹¹⁴ The cosmogony/cosmology that the Derveni author puts forward has a god very much in a steering or demiurgic mode rather than relying on sexual reproduction.¹¹⁵ Derveni papyrus Col. 12 is very interesting in the context of naturalising the Orphic imagery as here the author quotes the poem he is commenting on as saying 'so that he may rule on the beautiful home of snow-capped Olympus.'¹¹⁶ They then go on to explain that Olympus and time are the same and that this is indicated by the adjectives which Orpheus used.¹¹⁷

Heraclitus and the Derveni papyrus

It is significant that Col. 4 of the Derveni papyrus quotes important passages in Heraclitus, alludes to another and does so with every impression of approving of those passages. Col. 4 rejects a role for chance in explaining why the cosmos has order,¹¹⁸ and then we get a damaged piece of text which says:

Similarly Heraclitus ... the common ... overturns the private.¹¹⁹

This would seem to be an allusion to Heraclitus Fr. 89:

For those who are awake the cosmos is one and common, but those who sleep turn away each into a private world. We should not speak and act like sleeping men.¹²⁰

That is important because, as we saw in the previous section, dreams and dream prophecy were important in Homer, Hesiod and Greek culture generally and we might also take this passage as a rejection of dream divination. Derveni papyrus Col. 4 then goes on to give us some quotations from Heraclitus:

The sun according to nature is the width of a human foot
and does not exceed its boundaries. If he oversteps,
the Erinyes, the defenders of justice, will find him out.¹²¹

Heraclitus, Fr. 3 is:

Concerning the size of the sun: the width of a human foot.¹²²

Heraclitus, Fr. 94 is:

The sun will not overstep his measures. If he does, the Erinyes, the defenders of justice, will find him out.¹²³

This passage is fundamental to the stability of the cosmos in the Derveni papyrus cosmology because of the critical role that the sun plays. Derveni papyrus, Col. 9 tells us that:

Realising then that fire, when mixed with the others, disorders these things and prevents them from being set together by heat, he removed it sufficiently so that once removed it did not prevent the things that are solidifying.¹²⁴

Derveni papyrus, Col. 25 tells us that:

If the god had not wished the things now existing to be, he would not have made the sun. However, he made it of such a type and of such a size as was explained at the outset of this account.¹²⁵

The sun then is a specific size and has a specific role to play in this cosmology. There is a balance by which the sun dissolves the things that are now and the moon re-constitutes them.¹²⁶ If the sun were to grow too large, this would endanger the stability of the cosmos and the continual growth of the sun could lead to a widespread

degeneration of the cosmos. So the sun has a constant size and will not overstep his measures. As argued with Heraclitus in the previous section, here we have an assertion of regularity in the cosmos.

Hippocratics

Betegh has argued that the Derveni authors' criticism of religious and magical practitioners has parallels in the Hippocratic corpus.¹²⁷ He finds two important features:

First, we have the obviously dialectical, polemical use of the cosmological and physical doctrines in critical discussions about the theoretical foundations of the craft. Second, and more important, these texts show a conscious use of concepts and explanatory methods developed from the 'inquiry into nature' tradition, among which, first and foremost, there is the unifying concept of nature, and the conviction that the world is an ordered whole within which one can account for the diversity of phenomena and processes with a reductionist, mechanistic causal explanation, built on a few basic principles.¹²⁸

While I would have a few qualms about whether we get 'mechanistic causal explanation' in all places in both the Hippocratic corpus and the Derveni papyrus, I am in broad agreement with Betegh here.¹²⁹ The Derveni author uses similar strategies to attack religious and magical practitioners and to claim that they have the real knowledge and expertise. I would also agree with Betegh that the Derveni author gives a 'general theory of nature', that they explain everything in terms of this general theory and that there is no room for the intervention of the non-natural.¹³⁰ I would add three points to this. First, the Derveni author is keen to emphasise that there is no absolute coming to be and that the 'things that are' are combinations of things which have always been in existence. That would seem to militate against any non-natural intervention. Second, the Derveni author uses *epikratein* in Col. 19, where 'air dominates all as far as it wants to'. This is a verb we are familiar with from other presocratic uses where matter has the ability to organise itself and to behave in a regular manner.¹³¹ If Zeus is equated with air, as in Col. 19, then we have Zeus/air controlling all things, again seemingly ruling out any non-natural intervention. Finally, the comparisons with Heraclitus and the use of Heraclitus quotations in the Derveni papyrus strongly support the notion of an invariant cosmos.

The Derveni papyrus is then an interesting example of targeting. Instead of rejecting an apparently non-natural theogony, it attempts to decipher the poetic expression of that theogony in purely naturalistic terms. It does so by making interesting use of Heraclitus and by making some criticisms of religious and magical practitioners which have interesting parallels to the Hippocratics.

Anaxagoras

Anaxagoras of Clazomenae (500/497–428/427 BCE) is in some ways the easiest of the presocratics to deal with in the context of this book. The case for his giving natural explanations for everything is very strong and the case against minimal. In terms of basic principles for Anaxagoras, there is *nous*, the cosmic intelligence and there is matter. Anaxagoras fragment 12 tells us that:

Other things have a portion of everything, but *nous* is unlimited, rules itself and is unmixed, being alone by itself. If it were not by itself, and mixed with other things, it would have a share of all things, if it mixed with any. In everything there is a part of everything, as I said previously. Mixed things would hinder it, with the result that it would be able to rule nothing in the same way as it does now, alone and by itself. *Nous* is the finest and purest of all things, it has all knowledge concerning everything and it has the greatest power. *Nous* controls all things that have life, both the greater and the smaller. *Nous* controlled the revolution of the whole, such that it revolved in the beginning. At first it revolved in a small region, but now it revolves in a greater, and will revolve in a greater still. The things which are mixed and separated and divided are all known by *nous*. *Nous* ordered them all, this revolution in which the stars and the sun and the moon and the air and the aether which are being separated off. This revolution produced the separation. The dense is separated from the rare, and the hot from the cold, the bright from the dark and the dry from the moist. There are many parts of many things. Nothing is entirely separated or divided from anything else except *nous*. *Nous* is entirely alike, both the greater and smaller parts of it. Nothing else is like anything else, but what is most in each single entity is most clearly what it is and was.¹³²

So *nous* initiates and controls the revolution which separates out matter and is fundamental for the formation of the cosmos. Hippolytus tells us that for Anaxagoras:

Life forms were generated from moisture initially, but later on from each other.¹³³

Theophrastus tells us that:

Anaxagoras says that the air contains the seeds of all things and these are brought down together with water and generate plants.¹³⁴

This in turn gives us a zoogony. What is notable about *nous* in Anaximander is that it is never described as divine or given any similar epithet. As Broadie has pointed out, given that *nous* knows all things and controls all things, attributes that might lead one to expect that *nous* would be described as divine, it is not.¹³⁵ We might ask two standard questions of Anaxagoras' *nous* here. First, is it part of nature or in some way beyond nature? The answer is clearly that *nous* is part of nature for Anaxagoras and interacts with matter. Certainly *nous* has its own *phusis*. Second, does *nous* act in a regular manner? It controls the motion of matter in the vortex and there is no reason to suppose that *nous* does anything irregular. This gives a very strong basis for the natural explanation of all phenomena in Anaxagoras.

Anaxagoras and meteorology

Anaxagoras has a good deal to say about meteorological phenomena. This from Pseudo-Plutarch gives us all five Anaximander phenomena:

Anaxagoras says that whenever the hot falls into the cold (this is when part of the aether falls into the airy region), it makes thunder by the noise and lightning by the colour in comparison with the dark of the cold form. Further, it produces the thunderbolt by the extent and intensity of the light, a typhoon by fire composed of many more particles, and the fiery waterspout by mingling fire with clouds.¹³⁶

So we get thunder, lightning, thunderbolt, hurricane and even get typhoons by name, as in the Anaximander/Hesiod originals. Anaxagoras also has an explanation of the rainbow:

We call the rainbow the shining of the sun in clouds opposite to it.¹³⁷

It is interesting to note that this fragment comes from a Scholium on *Iliad* XVII/547, where the rainbow is sent by Zeus and is an omen of war or bad weather. Similarly, this is from a Scholium on *Prometheus Bound*:

According to Anaxagoras, the winds come from the earth, and according to Homer 'from the clouds of father Zeus' (*Iliad* II/146).¹³⁸

That is very interesting in targeting terms as it seems that not only did Anaxagoras target Homer but he was perceived by other scholars to be targeting Homer. We also have an account of clouds, snow and rain, etc. in Anaxagoras:

Anaxagoras explains clouds and snow in nearly the same way as Anaximenes, but Anaxagoras says that hail is produced whenever water droplets are pushed towards the earth from frozen clouds, are chilled, and become round by their descent.¹³⁹

Anaxagoras also gives a natural explanation of earthquakes. Pseudo-Plutarch tells us that:

Anaxagoras says that earthquakes occur because the air that gets under the earth strikes against the thickness of the surface of the earth. Then, because it is not able to make its escape from there, it shakes the surroundings by quaking.¹⁴⁰

Anaxagoras then gives natural explanations for a wide range of meteorological phenomena. We have all five of the Anaximander phenomena, along with other weather phenomena, rainbows and earthquakes. The scholia indicate that not only did Anaxagoras target Homer on at least some of these issues, but that he was perceived to do so as well.

Anaxagoras and experiment

Aristotle tells us that Anaxagoras engaged in some experiments related to the void:

Those who try to show that the void does not exist do not disprove what people really mean by it, but argue erroneously; this is true of Anaxagoras and of those who refute the existence of the void in this way. They merely give an ingenious demonstration that the air is something – by straining wine skins and showing the resistance of the air, and by cutting it off in clepsydras.¹⁴¹

All I want to take out of this is that we have some evidence for Anaxagoras doing experiments. Plutarch, in his account of the life of Pericles, says that:

Nor were these the only advantages which Pericles derived from Anaxagoras' acquaintance; he seems also to have become, by his instructions, superior to that superstition with which an ignorant wonder at appearances, for example, in the heavens possesses the minds of people unacquainted with their causes, eager for the non-natural, and excitable through an inexperience which the knowledge of natural causes removes, replacing wild and timid superstition by the good hope and assurance of an intelligent piety.

There is a story, that once Pericles had brought to him from a country farm of his, a ram's head with one horn, and that Lampon, the diviner, upon seeing the horn grow strong and solid out of the midst of the forehead, gave it as his judgment, that, there being at that time two potent factions, parties, or interests in the city, the one of Thucydides and the other of Pericles, the government would come about to that one of them in whose ground or estate this token or indication of fate had shown itself. But that Anaxagoras, cleaving the skull in sunder, showed to the bystanders that the brain had not filled up its natural place, but being oblong, like an egg, had collected from all parts of the vessel which contained it, in a point to that place from whence the root of the horn took its rise. And that, for that time, Anaxagoras was much admired for his explanation by those that were present; and Lampon no less a little while after, when Thucydides was overpowered, and the whole affairs of the state and government came into the hands of Pericles.

And yet, in my opinion, it is no absurdity to say that they were both in the right, both natural philosopher and diviner, one justly detecting the cause of this event, by which it was produced, the other the end for which it was designed.¹⁴²

This I hold to be interesting for several reasons. Whether the tale is in itself true, it is significant that Anaxagoras is perceived and portrayed in this manner. If the tale is true, or based more or less on some real event, that tells us a good deal about Anaxagoras and his attitude to such phenomena. Such things are not portents or omens but have a perfectly natural explanation. Finally a thought in relation to the Hippocratic *On the Sacred Disease*. There is a claim there that the head of a goat was opened and the brain found to be wet and foul smelling. The Hippocratic conclusion was that the disease had a physical basis and was not sent by the gods. Whether

the Hippocratics undertook that experiment has been questioned. Here we have a similar experiment in Anaxagoras. Was Anaxagoras inspired by the Hippocratic experiment? Perhaps he read *On the Sacred Disease* and was inspired by the account, the Hippocratics not having done the experiment. Does the fact that we have two experiments opening the heads of goats/sheep to disprove notions of non-natural intervention make those accounts more likely? My own view is that both accounts are based on real experiments because of the detail involved in the accounts. I do not think the Hippocratics would have invented the brain being foul smelling, nor do I think that the description of the brain here would have been invented, unless both accounts are an elaborate fraud.

Thucydides

Let us broaden the net outside of philosophers and medics for a moment to take in Thucydides the historian. His *The Peloponnesian War* has been thought by many to reject non-natural intervention, not least in relation to the great plague of Athens.¹⁴³ Lloyd comments that:

The turning away from the belief in the supernatural causation of disease and from the expectation of the efficacy of supernatural aid in combating them can be illustrated from outside the medical writers, in, for example, Thucydides 2. 47 and 2. 53.¹⁴⁴

More broadly, Finley comments that:

For Thucydides, history was in the most fundamental sense a strictly human affair, capable of analysis and understanding entirely in terms of known patterns of human behaviour, without the intervention of the supernatural.¹⁴⁵

Finley also argues that while Thucydides recorded omens and oracles and the effect they had on people and actions, he also went 'out of his way to denigrate popular trust in them'.¹⁴⁶ His sceptical attitude can be seen in *The Peloponnesian War* II/54.¹⁴⁷ An old saying was that when war with the Dorians comes, death/dearth will come with it. There had been debate as to whether the saying had the Greek *loimos* (death) or *limos* (famine). Thucydides says that now plague has come along with war with the Dorians, death was now being preferred, 'it was a case of people adapting their memories to suit their suffering'¹⁴⁸ and if there were another war with the Dorians occurring with famine, people would use the other version. Thucydides says this about the onset of the Athenian plague:

For a while physicians, in ignorance of the nature of the disease, sought to apply remedies; but it was in vain, and they themselves were among the first victims, because they oftenest came into contact with it. No human art was of any avail, and as to supplications in temples, enquiries of oracles, and the like, they were utterly useless, and at last men were overpowered by the calamity and gave them all up.¹⁴⁹

One might compare this with Epimenides' account of the Athenians being attacked by plague, when credit is given to purifications for eventually ending the plague.¹⁵⁰ There is a critique of this view of Thucydides though, which looks to *The Peloponnesian War* I/23 and the way in which it treats traditions:

Traditions which had often been current before, but rarely verified by fact, were now no longer doubted. For there were earthquakes unparalleled in their extent and fury, and eclipses of the sun more numerous than are recorded to have happened in any former age; there were also in some places great droughts causing famines, and lastly the plague which did immense harm and destroyed numbers of the people. All these calamities fell upon Hellas simultaneously with the war.¹⁵¹

Hornblower speaks of these as 'portentous things which "accompanied" the war' for Thucydides, in the context of questioning whether Thucydides' attitude to the plague is replicated throughout his work.¹⁵² This passage does not give us Thucydides' attitude to the traditions though. Thucydides merely records the traditions and what happened in the war. He may have done so because he believed in the portents and the occurrence of these phenomena was no accident, or simply because the traditions 'were now no longer doubted' and that was a historical fact which needed to be recorded along with the fact that these phenomena occurred. I am much inclined to the latter view, not least because of the way that Thucydides treats plague and portents in II/47ff. and the entirely matter-of-fact nature of II/28:

During the same summer, at the beginning of the lunar month (apparently the only time when such an event is possible), and in the afternoon, there was an eclipse of the sun, which took the form of a crescent, and then became full again; during the eclipse a few stars were visible.¹⁵³

There is no sense of anything portentous here or of anything other than a purely natural account. I see I/23 as simply recording fact without committing to anything that jars with the rest of Thucydides' account.

Aristophanes

Aristophanes wrote a number of comedies. I am interested here in one passage from *Clouds*, beginning around 365. The character Strepsiades offers explanations of meteorological phenomena in terms of the actions of the gods, while the character Socrates offers natural explanations of these phenomena. I am not interested here in Aristophanes' own opinion which would be difficult to decide upon from this passage, as he is humorous about the views of both sides. What I do think is significant is that this sort of debate about meteorological phenomena was satirised in a popular play. The issue of meteorology is clearly at the forefront of the traditional gods against natural explanations' debate and the play must be drawing on an ongoing debate to generate its humour. This suggests that the natural explanations given were not scattered, isolated comments on the part of each thinker but addressed a coherent,

ongoing theme. To return to the question about the Anaximander phenomena and the doxographers, the way that Aristophanes treats meteorology suggests there was a coherent tradition of natural explanation, rather than the doxographers pulling disparate comments together into categories they had created themselves.

In the play, Socrates claims that Zeus does not exist and in reply to Strepsiades' query as to what then makes rain, replies that it is the clouds.¹⁵⁴ Strepsiades believed it was Zeus 'pissing through a sieve' and wants to know what thunder is. Socrates explains that saturated clouds rocking together cause cloudbursts and that they are moved by the celestial basin, basin being a pun in Greek on *dinê*, usually translated in cosmological contexts as vortex.¹⁵⁵ Thunder is caused by clouds clashing and Socrates compares the noises to overeating, a rumbling stomach and farting.¹⁵⁶ Strepsiades then wants to know about thunderbolts, which he believes to be Zeus' instrument for punishing oath breakers.¹⁵⁷ Socrates points out that many oath breakers go unpunished while a thunderbolt had burnt down oaks at a temple, oaks being sacred to Zeus. Socrates explains thunderbolts are due to clouds swelling up like bladders and when hot air escapes it bursts into flame,¹⁵⁸ Strepsiades then rounds things off by comparing this to cooking a sausage but not pricking it, such that he was covered with fat and blood when it burst.¹⁵⁹

If such a version of the debate can turn up in the plays of Aristophanes, then the debate concerning meteorological phenomena, whether they were caused by the traditional gods or were susceptible to natural explanation must have been reasonably well known to the Greek public. If the attitude of the public was one sided in favour of the traditional gods, I would expect the humour of the play to be one sided as well, aimed at the new natural explanations. It is not though. There is humour in the depiction of Strepsiades' views as well. Rain is Zeus 'pissing through a sieve' and Zeus burns down his own sacred oaks with his thunderbolt.¹⁶⁰ Such an even-handed approach suggests a lively debate among the public. If so, some of the public must have sided with the new natural explanations, broadening our group of presocratics who rejected non-natural explanations.

Euripides

Euripides (c. 480–406 BCE) was a tragedian. I am interested in him because of what has become known as the Sisyphus fragment, a passage which gives an explanation of the origins of belief in the gods. It was believed that this fragment expressed the actual views of the tyrant Critias, but modern scholarship has shown that it is a fragment of a play where the lines are spoken by the character Sisyphus.¹⁶¹ The Sisyphus fragment runs:

There was a time when the life of human beings was disordered
and beastly, and life was ruled by force,
when there was no reward for the virtuous
nor any punishment for the wicked.
And then I think that humans decided to establish laws

to punish [wrongdoers] so that justice might rule
 and be master over crime and violence (hybris).
 And they punished anyone who did wrong.
 Then, since the laws held public deeds in check
 and prevented men from open acts of violence,
 but they acted secretly, then it was, I believe,
 that a shrewd and clever-minded man
 invented for mortals a fear of the gods, so that
 there might be a deterrent for the wicked,
 even if they act or say or think anything in secret.
 Hence from this source the divine was introduced [with the claim]
 that there is a deity who enjoys imperishable life,
 hearing and seeing with his mind, his thought
 and attention on all things, his nature so divine
 that he will hear whatever is said among mortals
 and be able to see whatever is done.
 If ever you plot some evil deed in silence,
 even this will not escape the gods. For they
 have knowledge. It was such stories that he told
 when he introduced this most delightful teaching
 and hid the truth with a false tale.
 He said the gods dwell there and placed them where
 they might make the greatest impression upon human beings,
 there where he knew that fears come to mortals
 and benefits also [to relieve] the miseries of life,
 from the vault on high, where they beheld
 the shafts of lightning and fearful blows of thunder
 and star-filled gleam of heaven,
 the beautiful design of Time the clever builder,
 parade-ground for the brilliant mass of the sun
 and source of rainfall moistening the earth below.
 Such were the fears with which he surrounded humans
 and by which this clever man established the deity
 in the proper place, with a handsome story,
 and extinguished lawlessness by means of laws.
 ...
 It was thus, I think, that someone first persuaded
 mortals to believe that there is a race of gods.¹⁶²

I do not want to suggest that these are the views of Euripides himself,¹⁶³ as the characters in his plays express many diverse religious views appropriate to character and situation and there is no reason to privilege this passage.¹⁶⁴ This passage is important though in showing that such views existed in the presocratic period and could be expressed by playwrights as well as philosophers. As we shall see later, we can find some similar ideas in Democritus,¹⁶⁵ so too in Prodicus. Sextus tells us that:

Prodicus of Ceos says: 'The ancients considered as gods the sun and moon and rivers and springs and in general everything that aids our life because of the benefits from them, just as the Egyptians consider the Nile a god.' He adds that for this reason bread was worshipped as Demeter, wine as Dionysus, water as Poseidon, fire as Hephaestus, and so on with each of the things that are good for use.¹⁶⁶

Later in antiquity, Epicurus and in particular Lucretius *On the Nature of Things* book V would build on accounts such as these. Again, if this sort of view was expressed in a play, it must have been reasonably familiar to the Greek populace, even if perhaps the majority would have rejected such a view. All I want to show here is that such views existed, are present in more than one source and indeed appear to have been widely known. I would also say in relation to these passages that I broadly agree with Lloyd (1979, pp. 12–13) that if we look at the religious criticism put forward by Xenophanes and Heraclitus it seems quite possible to put forward new religious ideas in this period. Euripides Fr. 910 is also of interest:

Blessed is the person who has undertaken enquiry, he will be neither hostile to nor do anything unjust to his fellow citizens, but looking at the unaging order of undying nature, he will say from what in what manner it was brought together.¹⁶⁷

As we do not know enough about the context of this fragment, we cannot ascribe these views to Euripides (they may simply be those of one of his characters) but this is a positive thing to say about people who undertake such enquiries and it is phrased in an interesting manner, giving a very strong sense of an unchanging order to the cosmos.¹⁶⁸ Euripides' *The Trojan Women* also has an interesting passage:

O thou that dost support the earth and retest thereupon, whoso'er thou art, a riddle past our ken! be thou Zeus, or natural necessity, or man's intellect, to thee I pray; for, though thou treadest o'er a noiseless path, all thy dealings with mankind are by justice guided.

That is significant because here it is possible to pray to Zeus, to natural necessity or to man's intellect. Granted this is an emotional appeal in the context of a play rather than a piece of philosophy or theology, and that the character Menelaus replies that the prayer is strange, but this again shows that it was conceptually possible to pray outside the confines of standard Greek religion.

Conclusion

In this chapter we have looked at a variety of examples of supposed naturalism and the targeting of non-natural explanations. With Xenophanes, we found not only his well-known critique of anthropomorphic religion, but natural explanations for St. Elmo's fire and an assortment of other meteorological phenomena, a rejection of divination and a concept of prayer different from intercessory prayer but in tune with his own system. Xenophanes actually names Homer and Hesiod as targets in his critique of

their religious views, but it is clear that he is targeting them in other places as well, not least in his description of meteorological phenomena.

We have seen Heraclitus too give a critique of religion and natural explanations for the five Anaximander phenomena and a rejection of dreams and divination as a source of knowledge as well as an important emphasis that neither gods nor men made this entirely orderly cosmos.

The Derveni papyrus provides an interesting example of an author trying to treat an Orphic theogony as a veiled natural theory and trying to tease a natural theory from the Orphic 'riddles'. Like Heraclitus there is an emphasis on an orderly cosmos and a rejection of dreams and divination and there are interesting parallels with the Hippocratic corpus in its treatment of magical practitioners.

Anaxagoras too gives natural explanations of the five Anaximander phenomena and more meteorological phenomena besides. It is clear that Anaxagoras had Homer in his sights too. Anaxagoras' experiment on the goat is both interesting in itself as a rejection of the non-natural, portents and divination and as a parallel to an experiment on a goat in *On the Sacred Disease*.

Although some doubts have recently been raised about Thucydides, these seem to me to be relatively trivial and Thucydides too gave natural explanations of phenomena including the great plague of Athens and was critical of diviners and those interpreting portents.

Aristophanes' *Clouds* is important in showing that the debate about meteorological phenomena was not confined to the *periphusis* tradition, but must have been reasonably well known to the Greek populace in order for Aristophanes' comedy to have been comprehensible. Its nature would seem to indicate that there was a coherent debate prior to Aristophanes and that at least some of the public would side with the new natural explanations. Euripides' *Sisyphus* is important in showing that radical ideas concerning a natural origin of belief in the gods existed, existed in more than one source, could be expressed in plays and were widely known of.

This of course is by no means to say that all historians and all playwrights took this view. Herodotus for one seems to believe in divine retribution for injustice though the infliction of disease.¹⁶⁹ Sophocles' *Oedipus Tyrannus* has plague inflicted by the gods for injustice with the necessity for purification to remove the plague.

One aim of this chapter has been to look at further evidence for two themes of this book. We have seen further evidence of the targeting of interesting, important or difficult-to-explain phenomena and further evidence of specific targeting of Homer and Hesiod. We have seen further evidence that the natural explanation of meteorological phenomena was a coherent programme and tradition among the presocratics, not merely a few disparate comments pulled together by the later doxographers.

A second aim of this chapter has been to see if the group of presocratics rejecting the non-natural could be expanded further beyond the presocratic philosophers and the Hippocratics. So while Xenophanes, Heraclitus and Anaxagoras fall into the category of the 'usual suspects' in this context, the author of the Derveni papyrus and Thucydides the historian do not. We also have some evidence from Aristophanes' and Euripides' plays that these debates were well known and that the naturalist side would have found some more supporters among the Greek populace.

Pythagoras and the Early Pythagoreans

I take the early Pythagoreans to cover roughly to the time of Plato and the key figures I want to look at in this chapter are Pythagoras (c. 570–c. 495) himself, Philolaus (c. 470–c. 385) and Archytas (428–347 BCE).¹ In terms of issues for this chapter, the Pythagoreans have been associated with a number of ideas that might be thought to involve the non-natural. We will need to look at the nature of Pythagorean metempsychosis, the idea that the soul survives the death of the body and moves on to a new body at the death of the old, perhaps an animal body. We will need to look at Pythagorean theology, alleged mysticism and the notion that Pythagoras might have been in some sense a shaman. With Philolaus, there is also an issue about astrology. There are also many issues concerning Pythagorean numerology, which I will deal with in a separate chapter, as they raise significant questions about the nature of numerology and of the extent of Pythagorean belief. As we will see, those generally held to be early Pythagoreans had quite a diverse range of beliefs. I will begin with Pythagoras himself. Clearly one can make a case that Pythagoras held non-natural beliefs, but on the evidence we have, it is surprisingly difficult to be specific on exactly what those beliefs were and there are natural belief alternatives. Much here depends on how we take the idea of metempsychosis, and to what extent it is proper to describe Pythagoras as a shaman, as some recent literature has. I will then look at Philolaus, where it is possible to make a case for non-natural belief based on possible beliefs in metempsychosis and astrology, but in fact the case for Philolaus having entirely natural beliefs is quite strong. I will finally deal relatively briefly with Archytas as from the evidence we have, there is no indication of any interest in metempsychosis, numerology, astrology or mysticism in his work. I will make a point here which I will return to later on. I do not wish to present Pythagoras to Philolaus to Archytas as a linear progression of increasing rationality. I take them rather as the three early Pythagoreans we know most about, taken in chronological order and as examples of Pythagorean diversity of views. Here we have a microcosm of the question of how many presocratics were naturalists. How many Pythagoreans were naturalists?

Pythagoras

Pythagoras was born in Samos c. 570 BCE and died c. 490 BCE. Around 530 BCE he relocated to Croton, which became an important centre for the Pythagoreans. The great difficulty for generating an accurate picture of Pythagoras is that Pythagoras himself wrote nothing and if his contemporaries wrote anything about him nothing of this has survived.² A further difficulty is that those who associated with Pythagoras may have kept a silence about his key views.³ All we know of Pythagoras comes from significantly later sources, many of which are unreliable. There was a strong tendency after Plato and Aristotle for Pythagoras to be aggrandised as a semi-divine or a divinely inspired figure and visionary and for the views of later thinkers to be attributed to him, especially those of the later Pythagoreans and aspects of Plato's metaphysics and cosmology. This poses the 'Pythagorean question', of the extent to which we can reconstruct the historical views of Pythagoras from the information we have available.⁴

Walter Burkert's *Lore and Science in Ancient Pythagoreanism*,⁵ has proved a critical turning point in studies of Pythagoras. Burkert sifted the wide range of material available and concluded that to find out about Pythagoras, we must look to the earliest and least corrupt sources on him, which meant looking at Plato and Aristotle. In this general strategy he has been followed by the work of Carl Huffman and Leonid Zhmud.⁶ While I disagree with Burkert on the issues of shamanism and numerology in Pythagoras and early Pythagoreanism, I follow his general methodology for dealing with the material.

The older picture of Pythagoras is that of a rational philosopher who first saw the importance of number in a proper description of the cosmos.⁷ So Pythagoras was an expert in mathematics and geometry, proved Pythagoras' theorem, made important discoveries on harmonics and mathematised harmonic theory. In astronomy Pythagoras believed there was a harmony of the spheres, believed the world was in some way constituted from numbers and that mathematics was the key to understanding the cosmos. It is notable though that while both Plato and Aristotle talk of presocratic natural philosophy, they do not give Pythagoras any significant role in this, nor do they recognise any Pythagorean cosmology prior to Philolaus.⁸ Plato for instance says that:

Such was Pythagoras, who was particularly beloved in this way, and his followers have a reputation for a way of life they call Pythagorean even down to this day.⁹

The picture that then emerges from looking just at Plato and Aristotle is radically different. It is of someone whose key beliefs were in the immortality of the soul and reincarnation and whose expertise was in the fate of the soul after death and in the nature of religious ritual. Pythagoras' major achievements are seen as the advocacy and founding of a way of life based on stringent dietary regulations, strict self-discipline and the keen observance of religious ritual. Pythagoras is not credited with a proof of Pythagoras' theorem, nor seen as a significant mathematician or geometer by Plato and Aristotle. Nor is Pythagoras seen as important by early histories of Greek

mathematics. Pythagoras is not associated by Plato and Aristotle with any harmonic theory.¹⁰ Tales that Pythagoras discovered the mathematical ratios underpinning harmonics are often demonstrably corrupt. The most popular of these tales has Pythagoras discovering these ratios when passing a blacksmith's shop and noticing that different-sized hammers produced different notes. However, the size/weight of a hammer has no direct relationship to the note produced when it hits something. Nor can Pythagorean musical ratios be found by comparing the sizes/weights of bells, by comparing how much water is in similar-sized glasses or by tensioning strings with weights in the Pythagorean ratios. The last sounds most plausible, but string tension does not relate to pitch in this way and only by stopping strings and listening to the pitch produced can the ratios be generated.¹¹

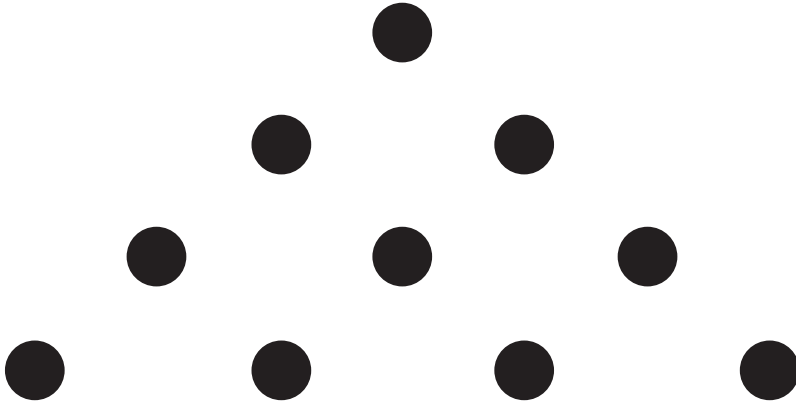
There is no need to choose absolutely between these two accounts on the basis that 'rational science' cannot or ought not to be associated with religious or magical ideas.¹² An account of Pythagoras largely as a religious figure does not preclude him having some interest in cosmology or harmonic theory. There is no need, and indeed there are no grounds, for treating all of Pythagoreanism as a monolithic set of beliefs deriving from a strict adherence to the views of Pythagoras himself. The balance of religious and scientific ideas may have been seen very differently by many of his followers.

There is evidence that Pythagoras was aware of something related to Pythagoras' theorem without having generated a proof himself. Possibilities here are an awareness of what are known as 'Pythagorean triples' (integer side lengths for Pythagorean triangles such as 3, 4, 5), which were known to the Babylonians, perhaps a significant diagram, perhaps the theorem but not the proof or perhaps he simply celebrated someone else generating the proof.¹³ There is also evidence that Pythagoras valued mathematics in education. Given the current state of the evidence, it is very difficult to determine with any certainty what Pythagoras' attitude to mathematics was, what his knowledge of mathematics was or what his contribution to mathematics was. My own view, for what it is worth, is that it is unlikely that Pythagoras proved what we know as Pythagoras' theorem. On the other hand I do find it likely that Pythagoras, or some early associate, did something significant in relation to Pythagoras' theorem. The often quoted tale that Pythagoras sacrificed oxen on discovering the theorem looks unlikely on the grounds of vegetarianism related to views on metempsychosis. I also find it likely that Pythagoras was to some extent interested in number and passed this interest on to his followers, without having discovered or been interested in the later, more ramified theories of the Pythagoreans.¹⁴

I agree with Zhmud¹⁵ and Huffman¹⁶ that neither Pythagoras, nor any known Pythagorean held the view that the world is actually constituted from numbers. This view of the early Pythagoreans seems likely to have originated with Aristotle.¹⁷ There is no trace of this view in the attested fragments. For Philolaus this seems demonstrably false as he believed the cosmos is in the first instance constituted from limited things and unlimited things.¹⁸ Aristotle's evidence seems to be confused and contradictory, saying in different places that numbers are the material basis of the world, that the Pythagoreans liken numbers to things and that the elements of numbers are the elements of things.¹⁹ One might also draw parallels with Aristotle's treatment of Thales and Anaximander where he attributes a single material substance to them

where their account is rather more complex.²⁰ As I will discuss later, it is likely that the Pythagoreans investigated various ideas about how number might relate to the world and there is an important sense in which it is proper to say that they have an arithmetical approach to cosmology rather than the geometrical approach pioneered by Plato in the *Timaeus*.

It may well be the case that the notion of the tetraktys can be traced back to Pythagoras. The tetraktys is the first four numbers and their sum is the Pythagorean perfect number, 10. They are often arranged in this manner:



Pseudo-Plutarch records a Pythagorean oath as:

No, I swear by he who gave to our heads the tetraktys,
The origin and root of immortal nature.²¹

There is evidence that the tetraktys was in some way related to the harmony sung by the Sirens, which in turn may be related to the notion of the harmony of the spheres.²² The harmony of the spheres is something of a misnomer when applied to the Pythagoreans, as we have no evidence they believed in celestial spheres. I will come back to this idea when I discuss Philolaus and numerological ideas later on. In relation to ideas on musical theory, Barker has commented that:

What we know, reasonably securely, about Pythagorean harmonics around 400 BC certainly presupposes an earlier tradition which may have gone back to Pythagoras himself.²³

While Zhmud is somewhat more optimistic:

Given an unbiased approach to the fifth- and fourth-century sources, we can state with justifiable confidence that Pythagorean harmonics *must* go back to Pythagoras himself.²⁴

Porphyry tells us that:

As Xenocrates says, Pythagoras also discovered that musical intervals do not come apart from number, for they are a comparison of a quantity with a quantity.²⁵

It has been argued that the early Pythagoreans could not have discovered the basic ratios of musical theory from Greek stringed instruments because there were no suitable instruments.²⁶ If we are thinking of the ratios generated by stopping strings, then that is so as early Greek stringed instruments did not have fingerboards. However, it is possible to generate the notes and length ratios using what are known as harmonics or flageolet tones.²⁷ This can be done in two ways. One can sound an open string and then lightly touch it half way along, when the octave will be heard. Alternatively one can touch the string half way along and then pluck the string. On a modern guitar, harmonics can easily be produced above the 5th, 7th and 12th frets and at other places as well. This would be enough to at least begin on the idea that there is a mathematical basis to music. Whether the Pythagoreans discovered this, or it was well known to musicians but then developed into something more mathematical by the early Pythagoreans is a question we are not in a position to answer.

The current state of the Pythagorean question then is that while Pythagoras was not the important mathematician, cosmologist and harmonic theorist of legend, he did have an interest in mathematical and related issues and that the tradition he fostered facilitated later Pythagoreans such as Philolaus and Archytas who developed many of the views that were later attributed to Pythagoras.²⁸ Exactly what is attributed to Pythagoras, even within this general structure, still remains a matter of controversy though and that relates to the issue of how much we consider Pythagoras to be within the mainstream of presocratic natural philosophy. One can emphasise the shamanic aspects of Pythagoras, with important new teaching on the fate of the soul and strict rules governing behaviour and ritual, as Dodds and Kingsley have done and push Pythagoras outside this tradition. Which account is chosen by modern scholars has tended to reflect a broader philosophical agenda on their part.²⁹

One can try as Kahn and Riedweg have done, to give Pythagoras some role as a cosmologist, through the relation of musical theory via the harmony of the spheres to the nature of the cosmos, when Pythagoras is brought into the presocratic cosmological tradition again.³⁰ It is difficult on the evidence we have available to come down conclusively on either side of this debate. All the more so since despite the advances made by Burkert there is still considerable dispute over which evidence should be accepted as genuine and agendas to push Pythagoras out of the mainstream of presocratic natural philosophy or to draw him into it often determine which evidence is accepted.³¹

Metempsychosis

The key passage for the idea of metempsychosis,³² the transmigration of the soul from one body to another at death, comes from Xenophanes:

On the subject of reincarnation, Xenophanes tells a tale which begins: Now I turn to another account and I will show the way. He says this about Pythagoras: Once he passed a young dog which was being mistreated, and taking pity he said: 'Stop, do not beat it, that is the soul of a man who was my friend, I recognised it when it cried aloud.'³³

How reliable in detail this report is may be open to question as Xenophanes was an opponent of Pythagoras and probably does not cast this anecdote in a favourable manner. That Pythagoras and some later Pythagoreans believed in metempsychosis is generally agreed though. Whether this is something original to Pythagoras, or is influenced by Orphic or Egyptian ideas is also contentious.³⁴ There is though some consensus that this is a significant move away from the Homeric conception of the fate of the soul. The standard passage for comparison in Homer is where Achilles says:

I would rather be above ground still and labouring for some poor and portionless man, than be lord over all the lifeless dead.³⁵

We have very little definite information about the nature of metempsychosis. One problem is that we have very little on Pythagoras' account of the soul and we do not know if the entire soul or only part of it was supposed to transmigrate. We have nothing at all on the nature of the actual transmigration, of how the soul moved from its previous host body to the next host body. We do not know if every soul underwent transmigration, we do not know the extent of how many living things could participate (animals other than dogs, plants?) and we do not know if there was eventually an escape from the sequence of transmigration, either by death of the soul or escape to some heaven or state which did not involve embodiment.³⁶

This uncertainty makes it very difficult to say whether anything non-natural was involved in metempsychosis. Clearly that is one view of metempsychosis, but it is entirely possible to construct others as well. Huffman, for instance, has argued that both Philolaus and Pythagoras had material conceptions of the soul and that only part of this soul, that to do with the seat of the emotion and sensation is transmitted in metempsychosis.³⁷ The soul is drawn in at first breath and expelled with the last breath. As the seat of this part of the soul is the heart, only other living things which have hearts can take part in metempsychosis. This is in many ways an attractive view, not least because one might then draw parallels with the origins of humans and the origins of the cosmos. So there is evidence that for the Pythagoreans:

Directly after birth an animal, whose body is mainly hot, will draw in a breath from the outside, which is cold, and then expels it as if of necessity.³⁸

On the issue of the cosmos, Stobaeus tells us that:

In the first book of *'On the Philosophy of the Pythagoreans'*, he (Aristotle) writes that the heavens are one, and that from the unlimited are drawn time, breath and the void. It is the void which distinguishes the nature of each thing.³⁹

This may be a biological analogy, certainly it can be compared with the Pythagoreans on the birth of animals. Finally, there is the view of Barnes on metempsychosis, who believes that there is a serious philosophical analysis of personal identity behind this theory:

Metempsychosis is no rough dogma: it is a rational theory, capable of rigorous statement and implying a respectable account of the nature of personal identity; it was advocated by Pythagoras on solid empirical grounds. We are far from mystery-mongering.⁴⁰

Barnes is notoriously sceptical and critical of some aspects of Pythagorean thought, notably numerology, so this is an interesting assessment, both in itself and in the idea that there is some serious philosophy behind Pythagorean ideas, a thought I will return to later in relation to numerology.

Heraclitus on Pythagoras

Heraclitus was a critic of Pythagoras and could be quite acerbic. His most famous saying is that:

Much learning does not teach intelligence – if it did, it would have taught Hesiod, Pythagoras as well as Xenophanes and Hecateus.⁴¹

There are two other passages which are significant in producing a picture of Pythagoras independent of anything that Plato or Aristotle have to say. Heraclitus says that:

Pythagoras, son of Mnesarchus, practiced enquiry far beyond all other men and selecting these made them his own, wisdom, polymathy, malpractice (*kakotechnien*).⁴²

This is interesting in confirming the view of Pythagoras as a polymath though the attribution in the hands of Heraclitus here may be double-edged as in the previous fragment. The final word in this passage, *kakotechnia*, is very interesting. LSJ give 'base artifice, malpractice, as law-term, fraudulent or malicious conspiracy, false artifice.' It is unclear precisely what Heraclitus meant by this word.⁴³ Some sort of (perceived) organised fraud is a possibility, as is criticism of practices that failed in their claims or were malicious in their intent. I don't see any evidence though that we should see parallels with the word 'maleficia,' evil doing, often associated with a pact with the devil and commonly used during the European witch hunt. Heraclitus also describes Pythagoras as '*kopidôn archêgos*,'⁴⁴ which can be translated in several ways, such as 'original chief of wranglers'⁴⁵ or 'prince of imposters'⁴⁶ or 'the chief of swindlers.'⁴⁷ As LSJ give 'prater, liar, wrangler' for *kopis* and 'beginning, originating; primary, leading, chief' for *archêgos*, we may have to slip outside scholarly language here to get the full force of this expression and I would suggest 'the original bullshitter' or 'the chief bullshitter' as crude but probably accurate and carrying the pejorative sense that Heraclitus may well have intended. It is notable that Heraclitus, a great proponent of cosmic order, does not criticise Pythagoras for any suggestion that the cosmic order might be broken or manipulated.

Pythagoras as a shaman?

Was Pythagoras some form of a shaman? In the twentieth century Dodds has argued that he was,⁴⁸ Burkert⁴⁹ accepted this to some extent as did Cornford,⁵⁰ Kingsley has argued strongly for this view,⁵¹ while more recently Huffman,⁵² Bremmer,⁵³ and Zhmud have rejected the idea.⁵⁴ The Kirk, Raven and Schofield view is that:

It is doubtful how far a historical case can be made for an influence upon Archaic Greece from Central Asian shamanistic cultures, or to what extent an institution central to the life of politically primitive nomadic peoples could in any case illuminate the activities of a Greek sage in the more complex society of a rich and powerful city state.⁵⁵

However, this does little to address what is perhaps the key question posed by Dodds:

Why should we attribute to the ancient Greeks an immunity from 'primitive' modes of thought which we do not find in any society open to our direct observation?⁵⁶

It is possible to make the case for influence, as Kingsley has done, citing a path through ancient Iran.⁵⁷ Zhmud though has now cast considerable doubt on the view of Meuli, that there was a route of transmission via the Scythians on the Black Sea coast, by showing that it is highly doubtful that the Scythians were in any proper sense of the word shamanic.⁵⁸ It is also possible to take the view that shamanism is a ubiquitous phenomenon, whose clearest expression may be Siberian, so doing away with the need for a path of influence.⁵⁹ I see nothing in the nature of a Greek sage nor in the nature of Greek society, however complex or wealthy it is perceived to be, which would preclude an ancient Greek being a shaman, at least in the looser sense of claiming to enter into ecstatic states, claiming to communicate with spirits and having a retinue of followers believing in their abilities. A great deal here depends on whether one wants to assert that Pythagoras was indeed a shaman and so had all the characteristics of a shaman, or whether he could reasonably be likened to a shaman. It is quite possible to accept that Pythagoras had some traits in common with shamen without accepting that Pythagoras was a shaman. So for instance, one might happily accept that Pythagoras was a charismatic leader of a religious grouping that took part in rituals.⁶⁰ The Oxford English Dictionary gives this definition of a shamen:

A person regarded as having access to, and influence in, the world of good and evil spirits, especially among some peoples of northern Asia and North America. Typically such people enter a trance state during a ritual, and practise divination and healing.⁶¹

In his paper 'What is a Shaman? Definition, Origin and Distribution', Walsh says that:

The term itself comes from the word saman of the Tungus people of Siberia, meaning 'one who is excited, moved, raised'.⁶²

Shirokogoroff, who was one of first to investigate the shamen of the Siberian Tungus people said that:

In all Tungus languages this term (saman) refers to persons of both sexes who have mastered spirits, who at their will call and introduce these spirits into themselves and use their power over the spirits in their own interests, particularly helping other people, who suffer from the spirits; in such a capacity they may possess a complex of special methods for dealing with the spirits.⁶³

Walsh offers this definition of shamanism:

Shamanism might be defined as a family of traditions whose practitioners focus on voluntarily entering altered states of consciousness in which they experience themselves, or their spirit(s), travelling to other realms at will and interacting with other entities in order to serve their community.⁶⁴

More recently, discussions on the definition of shamanism have shifted in focus from the individual shamen to the cultures they are part of. Jolly, in his paper 'On the Definition of Shamanism', says that:

The following could perhaps serve as a definition: cultures that can be classified as shamanic are those which, as a minimum requirement, possess religious functionaries who draw on the powers in the natural world, including the powers of animals, and who mediate, usually in an altered state of consciousness, between the world of the living and that of the spirits including the spirits of the dead.⁶⁵

The notion of a trance, or some form of ecstatic state leading to access to a spirit world is the key part of shamanism. There is though no reliable evidence that Pythagoras entered trances or ecstatic states and the notion of entering a spirit world is contrary to the principles of metempsychosis.⁶⁶ If souls do not enter into some sort of afterlife, but transmigrate to other bodies, what spirit world is there for Pythagoras to enter via some form of ecstatic state? It is perhaps significant that within shamanism proper there is no trace of any view like metempsychosis. One could perhaps construct some sort of view where they are compatible (if one ultimately escapes reincarnation to a spirit realm, for instance) but they are not easily or naturally reconciled, there is no evidence for such a reconciliation in Pythagoras and no historical record of their reconciliation anywhere else.

There are some affinities between Pythagorean ideas and those of the Orphics, but this line of enquiry is unlikely to lead us very far. The exact nature of Orphism and Orphic practice remains obscure and it is by no means clear how Pythagoreanism or individual Pythagoreans related to Orphism or indeed individual Orphics. There are similarities, though they are probably not exact, in that the Orphics held that the soul is a prisoner in the body until the soul makes recompense. They believed that they could speed this process by purification and ritual. Whether Pythagoras or later Pythagoreans believed that the soul could escape the cycle of reincarnations is not known. Here I follow the view of Kirk, Raven and Schofield who suggest that the Orphics and the Pythagoreans were two separate religious movements with certain affinities and differences who may well have borrowed ideas from each other.⁶⁷ It is virtually impossible to decide on the evidence we have who borrowed what from whom.

Pythagoras and meteorology

One of the key themes of this book has been the attitude of the presocratics to meteorological phenomena. We have little information from Pythagoras and the Pythagoreans on these issues, but what we do have indicates that Pythagoras and

at least some Pythagoreans did not treat all meteorological phenomena as entirely natural. So Aristotle says that:

If it thunders, then if what the Pythagoreans say is true, then this is to threaten those in Tartarus, in order that they will fear.⁶⁸

Aristotle also tells us that Pythagoras said:

The origin of earthquakes was nothing but the gathering of the dead, while the rainbow was the gleam of the sun and the echo which often falls upon our ears is the voice of more powerful beings.⁶⁹

Porphry informs us that Pythagoras:

Said some things in a mystical and symbolic manner and Aristotle has written many of these down; he considered the sea to be the tear of Kronos, the Bears to be the hands of Rhea, the Pleiades to be the Muses' lyre, the planets to be Persephone's dogs and the ringing sound of the bronze to be due to a daimon imprisoned in the bronze.⁷⁰

Aristotle on Pythagoras

In contrast to this evidence on meteorology, we have some other evidence from Aristotle:

The 'Pythagoreans' treat of principles and elements stranger than those of the physical philosophers (the reason is that they got the principles from non-sensible things, for the objects of mathematics, except those of astronomy, are of the class of things without movement); yet their discussions and investigations are all about nature; for they generate the heavens, and with regard to their parts and attributes and functions they observe the phenomena, and use up the principles and the causes in explaining these, which implies that they agree with the others, the physical philosophers, that the real is just all that which is perceptible and contained by the so-called 'heavens'.⁷¹

If it is true that the Pythagoreans' 'discussions and investigations' are indeed 'all about nature' and that what is real is 'perceptible and contained by the so-called heavens' then there seems to be no room for anything other than the natural. Aristotle also tells us that:

Contemporaneously with these philosophers and before them, the so-called Pythagoreans, who were the first to take up mathematics, not only advanced this study, but also having been brought up in it they thought its principles were the principles of all things. Since of these principles numbers are by nature the first, and in numbers they seemed to see many resemblances to the things that exist and come into being.⁷²

Whether number is all things or is part of the explanation of all things need not concern us here. The key point is that all things are dependent on number. That again

makes it difficult to see how there could be anything beyond the natural. One might want to say that this applies only to the later Pythagoreans and not to Pythagoras himself, but even then it is quite an important statement about early Pythagoreanism. It is worth noting that Aristotle does not criticise Pythagoras for having non-natural beliefs.

Pythagoras' powers?

Pythagoras was associated with many strange powers and deeds. Those mentioned by Aristotle are that he was seen in two different places at exactly the same time, that once when he stood up at the theatre he revealed that one of his thighs was golden and that when crossing the river Kosas the river spoke to him and many people heard this.⁷³ So too he is supposed to have prophesied the coming of a white, female bear, to have killed a dangerous snake by biting it and to have prophesied to his followers approaching political strife.⁷⁴ Two unknowns here are the attitudes of Aristotle and Pythagoras to these claims. Given Aristotle's attitude to nature, one would expect that Aristotle is reporting these tales about Pythagoras without believing them. What of Pythagoras though? Did he claim any prophetic or non-natural ability? That we simply do not know.

Kingsley has argued that Pythagorean food prohibitions and abstinence have considerable similarities with Greek ritual and magic, as well as with the preparations to receive dream oracles.⁷⁵ Doubtless that is so, but what follows from it is another matter. Can we then infer that the Pythagoreans had the same aim in their prohibitions and abstinence? It is possible that at least some of them had similar aims, but there are other explanations here as well. It is by no means clear that the early Pythagoreans refused to eat different foods for the same reason. They may not have eaten meat, or at least some meats, for reasons related to metempsychosis while refusing to eat beans either because they are hard to digest or cause flatulence.⁷⁶ The extent to which the early Pythagoreans adhered to these taboos is unknown.⁷⁷ As for Pythagoras himself, again we simply do not know.

On the issue of Pythagoras' supposed golden thigh, I agree with Kingsley that we cannot dismiss the evidence that there was such a legend and that the legend was early. The evidence is in Aristotle and if we accept, with due reservation, the evidence of Aristotle as fundamental for our picture of Pythagoras and the early Pythagoreans, then we have to accept the evidence that there was the tale of the golden thigh.⁷⁸ Exactly what we make of that is another matter. We do not know who first attributed a golden thigh to Pythagoras or why. It may be, as Kingsley has argued, that this has considerable significance in terms of magic, ritual and access to the realm of the dead.⁷⁹ How widespread such a view was among the early Pythagoreans though remains unknown.

Kingsley has an interesting cumulative case that there is a good deal of varied evidence which points to the early Pythagoreans being interested in magic, ritual and access to the realm of the dead. My view in relation to this goes back to the quote from

Zhmud at the beginning of this chapter. The early Pythagoreans seem to have held a great diversity of views with seemingly little in the way of a central doctrine. Indeed, we still debate what it is that is central to Pythagoreanism and what views are common to all the Pythagoreans. I am quite happy to accept that some early Pythagoreans were interested in magic, ritual and access to the realm of the dead, and that may well have involved them in belief in the non-natural. The problem is that on the evidence we have, we do not know and have no way of knowing how widespread such views were among the early Pythagoreans. Much the same can be said about the two supposed groups of Pythagoras' immediate followers, the *akousmatikoi* and the *mathematikoi*, the listeners and the learners. I say 'supposed groups' here as a sharp division of this kind between the early followers of Pythagoras may be a later imposition.⁸⁰ The classic statement of the division between the followers of Pythagoras is Cornford, who says:

Tradition points to a split between the Acousmatics, who may, perhaps, be regarded as the 'old believers' who clung to the religious doctrine, and the Mathematici, an intellectualist or modernist wing, who, as I believe, developed the number doctrine on rational, scientific lines, and dropped the mysticism.⁸¹

However, I would, as I have done throughout this book, caution against such a bipolar split between religion and science and at least leave open the possibility that early Pythagoreanism was more of a broad church where some may have felt happy with a mix of what Cornford categorises here as religious and scientific views.

This section on Pythagoras may seem non-committal, but that I hope is a fair reflection of the evidence we have about Pythagoras. It is difficult on that evidence to give a precise and concrete picture of his thought. It is possible, as we have seen, to draw Pythagoras outside of the presocratic philosophical tradition by emphasising the religious and shamanic nature of his thought. It is possible to draw him back in by attributing the basics of the tetraktys, music theory and the harmony of the spheres to him. A balanced view, I suspect, is that Pythagoras is on the margins of the presocratic investigation of nature tradition, neither definitively in it nor outside it. There is nothing conclusive which attributes a belief in the non-natural to Pythagoras. Metempsychosis could be construed naturally and while there may be some affinities with shamanism, there is no evidence that Pythagoras entered into ecstatic states in order to access a supposed spirit realm. The meteorology is of a different tenor to that of the mainstream of presocratic philosophy, but whether we can attribute that to Pythagoras himself is another issue. Some Pythagoreans may have gone in for non-natural explanations of meteorological phenomena, but that does not commit either Pythagoras or the rest of the Pythagoreans to them.

Philolaus

Philolaus of Croton lived from around 470 BCE to around 385 BCE. Philolaus wrote one book, *On Nature*, which if Pythagoras indeed wrote nothing, is probably the first book of the Pythagorean tradition, of which a few fragments survive. He worked on

astronomy, cosmology and cosmogony, on harmonic theory and medical theory. As *On Nature* was the standard title for presocratic works on the natural world, Philolaus immediately places himself in that tradition. In terms of general principles, there is nothing problematic in what Philolaus has to say. Philolaus Fr. 1 says that:

Nature in the cosmos was fitted together out of unlimited and limited things, both the whole cosmos and the things in it.⁸²

Philolaus Fr. 2 tells us that:

It is necessary that all the things that are are limiting, or unlimited or limiting and unlimited. As it is evident that they are not constituted entirely from limited things or from unlimited things it is clear that the cosmos and the things in it were fitted together by limited and unlimited things. This is clear from things in their actions.⁸³

The character of the unlimited and the limited things may not be entirely evident, but it is clear that this conception of the cosmos does not require anything non-natural. Philolaus' epistemology is also based on the idea of limit and number. Philolaus Fr. 3 runs:

According to Philolaus, there will not be anything that is going to know if everything is unlimited.⁸⁴

While Philolaus Fr. 4 tells us that:

All things which are known have number. Without this, it is not possible for anything at all to be understood or known.⁸⁵

Again, while the details of this may be obscure, there seems to be no reference to and indeed no room for anything non-natural here.

Philolaus and metempsychosis

Did Philolaus believe in metempsychosis? It is perfectly viable simply to deny that Philolaus believed in metempsychosis.⁸⁶ There is no direct evidence in the fragments that he had such a belief. If, quite rightly, we are rejecting the idea that Pythagoreanism was a monolithic entity then the fact that Pythagoras believed in metempsychosis does not entail that all of his followers did too. Here we need to ask an important question. As Netz has put it: 'What made the Pythagoreans *Pythagorean*?'⁸⁷ One hypothesis on what makes someone a Pythagorean is that they have a belief in metempsychosis. That though is one hypothesis among many and not, in my view, the most plausible. One problem for the metempsychosis hypothesis is that while Archytas is widely accepted, both by ancients and moderns as a Pythagorean, there is no trace of any belief in metempsychosis in his work. Much more plausible, as a single defining characteristic of what it is to be a Pythagorean is a belief that number is fundamental to understanding and interacting with the cosmos. This works well with the modern view of

Pythagoras, which while it does not consider Pythagoras to be a mathematician, does trace an interest in the tetraktys back to him and does allow him a role in fostering the investigation of number. This works for the *akousmatikoi*, who again were not mathematicians per se, but were again interested in the tetraktys and used number in their rituals. It will of course work well for the *mathematikoi* and for Philolaus and Archytas. It is also worth considering what Aristotle meant when he said that 'Plato always Pythagoreanises.' Does he mean that Plato always applies ideas related to the notion of metempsychosis? I would suggest that Aristotle is more likely to have meant that Plato always applies number or always thinks in terms of mathematics as the key discipline. Whether the number hypothesis for identifying Pythagoreans is fully adequate though is open to some doubt, as I think is the idea that the Pythagoreans can be characterised by any single defining characteristic. More probable for the ancients (and here I have Plato and Aristotle in mind) and more useful for us moderns is the idea that there were a group of ideas for the Pythagoreans and one could be, or be considered to be Pythagorean if one bought into at least some but not necessarily all of those ideas, or bought into all the ideas but some much more fully than others. One could then have Pythagoreans interested in number but not in metempsychosis, or interested in metempsychosis with no great interest in number. That I think is important in accounting for the breadth of interest among the *akousmatikoi* and the *mathematikoi*.

Plato in the *Phaedo* attributes a ban on suicide to Philolaus,⁸⁸ but no reason is given for that ban. The idea that the soul is an attunement is also discussed in the *Phaedo* but rejected on the basis that if this were so, the soul would die with the body.⁸⁹ However, it is by no means clear that the theory being discussed is that of Philolaus, or if it was whether Philolaus, believing the soul to be a harmony, could believe in metempsychosis or not. This is what Philolaus has to say about intellect and soul:

There are four principles of rational animals, as Philolaus said in his *On Nature*: brain heart, navel and genitals. The head for the intellect, the heart for soul and sensation, the navel for formation and first growth, the genitals for sowing seed and generation. The head has the principle of man, the heart of animals, the navel of plants and the genitals of all. For all things propagate and grow from seed.⁹⁰

It has been suggested that Philolaus believed in some form of 'occult soul' or 'mysterious *daimon*', which underwent transmigration.⁹¹ If we take it that Philolaus believed in metempsychosis, then there is a need to suppose something which transmigrates. If that is not the ordinary soul, then it must be some occult soul or *daimon*. Fragment 13 tells heavily against that as it seems to give a catalogue of the key parts of rational animals but makes no mention of any extra soul. It is easiest simply to take the view that Philolaus did not believe in metempsychosis.

Even if Philolaus believed in metempsychosis, as we saw with Pythagoras this does not in itself entail a non-natural belief. Huffman has argued a similar position on a material soul for Philolaus with the same notion of the soul being drawn in with the first breath and being exhaled with the last breath.⁹² We simply do not have enough information on Pythagoras and the early Pythagoreans to determine how widespread the belief in metempsychosis was or whether it involved any non-natural belief. If

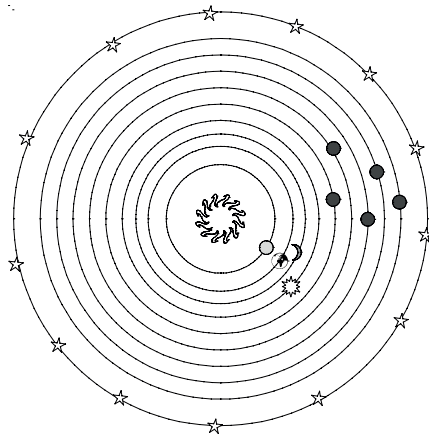
asked for an opinion I would say that Philolaus did not believe in metempsychosis and that if he did, given the nature of the rest of his thinking, it is likely that nothing non-natural was involved.

Philolaus and harmony

Philolaus' theory of music is a form of what is known today as just intonation, or Pythagorean intonation, as it is based on ratios of small integers.⁹³ Who discovered the basic relationships between musical notes and the length a string on an instrument is stopped at is now lost, though as we saw with Pythagoras there are many apocryphal stories on this issue. Whoever discovered this, Philolaus produced the first extant theoretical account.⁹⁴ If the length of a string is halved, then the note it sounds is an octave above the first note, and ratio of the string lengths is 2:1. If the ratio is 4:3 we get a musical fourth and if the ratio is 3:2 we get a musical fifth. Both of these notes sound harmonious when played with the original note. A fourth and a fifth make an octave ($4/3 \times 3/2 = 12/6 = 2/1$). The difference between a fourth and a fifth is $9/8$ ($4/3 \times 9/8 = 3/2$). The ratio used to generate one whole tone is $9/8$. So if the root note is taken as 1, the first note in the scale will be $9/8$. The second note will be $9/8 \times 9/8 = 81/64$. The Philolean semitone is generated by 256:243. The third note in the scale is $81/64 \times 256/243 = 4/3$ (a musical fourth). The following note is $4/3 \times 9/8 = 3/2$ (a musical fifth), then $3/2 \times 9/8 = 27/16$, then $27/16 \times 9/8 = 243/128$ and finally $243/128 \times 256/243 = 2$, which gives the octave as a ratio of 2:1.⁹⁵ The Philolean scale is mathematically very pure, using only powers of 2 and 3. The ratio 256/243 initially looks obscure, but in fact is, in modern notation $2^8/3^5$.

Philolaus and astronomy

With Philolaus we have a surviving Pythagorean cosmology, depicted in this diagram:



Aristotle tells us that:

The Italian philosophers known as Pythagoreans take the contrary view. At the centre, they say, is fire, and the earth is one of the stars, creating night and day by its circular motion about the centre. They further construct another earth in opposition to ours to which they give the name counterearth. In all this they are not seeking for theories and causes to account for observed facts, but rather forcing their observations and trying to accommodate them to certain theories and opinions of their own.⁹⁶

Working outwards from the middle, there is a central fire, a counter-earth, the earth, the moon, the sun, the five naked eye planets (Mercury, Venus, Mars, Jupiter, Saturn) and the stars. This cosmology is notable for being almost unique in antiquity in displacing the earth from the center of the cosmos. Instead there is a central fire (not the sun) with the earth and sun orbiting around it. No reason has been passed down to us as to why the earth was placed in motion. How well this model could account for the phenomena is still open to debate, as is whether accounting for the phenomena or some form of religious/eschatological symbolism was its main function. Huffman has made a very good case that this is a serious piece of astronomy/cosmology from the presocratic period,⁹⁷ and is joined in that estimation by Kahn⁹⁸ and Graham.⁹⁹ On this I would agree and would add something which I have argued in the context of Plato's astronomical model in the *Timaeus*.¹⁰⁰ Is it the case that for every model of the heavens we have from antiquity, that the author believed it covered all of the phenomena known to them? The answer to that is a clear no, as Simplicius, quoting Sosigenes, tells us that:

These [unrolling spheres] of Eudoxus' school do not save the phenomena, not only those that were found later, but also those known before (*ta proteron gnôthenta*) and recognised by them.¹⁰¹

So even if Philolaus' model could not reproduce all the phenomena and even if he was aware of that, those are not grounds for supposing that the main importance of the model was eschatological rather than astronomical. Philolaus' model does include some important ideas, not least the notion of perfectly regular circular motion and an ordering of planets in relation to period.¹⁰² It is interesting to note that the phenomena that Simplicius refers to as problematic for Eudoxus are not, at least in principle, problematic for Philolaus – variations in the distance of planets from the earth, variations in the apparent size of the moon, variations in type of eclipse from full to annular.¹⁰³ One problem with determining some sort of religious/eschatological significance from this cosmology is that we do not know Philolaus' views here and he does not seem to have a belief in metempsychosis. Aristotle is critical of Philolaus on slightly different lines, saying that the reason Philolaus supposed there to be 10 heavenly bodies was that 10 was the perfect Pythagorean number.¹⁰⁴ We will look at this a little more closely in a moment, in relation to numerology among the Pythagoreans.

One explanation of why there is a central fire in Philolaus' cosmology is his cosmogony. Fragment 7 has a hearth in the centre of the sphere as the first thing to be

generated as the cosmos is fitted together. The cosmos comes to be from the unlimited and limiters. The outline of Philolaus' view of unlimited and limiters is clear enough even if we lack enough information to say much in detail about this view. It would seem that fire is first limited in the centre of the cosmos and then other unlimiteds are drawn in. There is some debate on exactly what these are, but it is likely they include breath, space and time. There is also debate concerning whether number is generated with the cosmos and whether the central fire is in some sense the number one or whether being the first unity, one describes the central fire. In common with other presocratic cosmogonies, limited and unlimited are seen as existing prior to the organization of the cosmos so there is no creation *ex nihilo*.

Philolaus and astrology

Did the early Pythagoreans, and in particular Philolaus, have any belief in astrology? There are several passages which might suggest they did, of which the following from Proclus is typical:

With the Pythagoreans we find different angles dedicated to different gods, as Philolaus did, giving the angle of the triangle to some and the angle of the square to others.¹⁰⁵

Huffman and Kingsley have disagreed on whether this cluster of fragments are genuine in relation to Philolaus and whether they refer to some form of astrological practice.¹⁰⁶ The basic idea is that either three squares or four triangles can be inscribed in a circle, offset at the same angle, when the twelve points lying on the circle can then be interpreted as parts of the zodiac, with the squares or triangles being interpreted as seasons or as elements. There have been several attempts to flesh this basic idea out into something more detailed, without any of them being convincing. Older authorities such as Bouch-Leclercq and Neugebauer date the development of Greek astrology to the third century BCE, post dating Philolaus.¹⁰⁷ More recent work has allowed for an earlier knowledge of Babylonian sources and a recognition that Babylonian astronomy was hardly separable from Babylonian astrology, so if the former were known at least something would be known of the latter. Huffman argues that these fragments do not go back to Philolaus but originate from the early academy as part of attempts at commentary on the *Timaeus*.¹⁰⁸

Even if these fragments are genuine and do refer to some form of astrological practice (personally I have doubts on both counts), does that commit at least some of the Pythagoreans to a belief in the non-natural? There is nothing here to indicate that it does. It is possible that the angles and gods material here refers to some form of astrology, but it is by no means certain and there are other plausible possibilities. As Huffman has suggested, the 12 point arrangement may merely indicate the 12 months of the year.¹⁰⁹ Without further detail of how the alleged astrology is supposed to work though, we cannot assume that it required anything non-natural.

One parallel here might be with Johannes Kepler, the great astronomer of the late sixteenth and early seventeenth centuries, who was interested in astrology as well

as astronomy and cosmology. In *On the More Certain Fundamentals of Astrology*,¹¹⁰ Kepler begins by discussing the physical causes by which astrological influence is transmitted¹¹¹ and then moves on to the geometrical causes.¹¹² The geometrical causes relate to how the heavenly bodies form angles relative to us on earth and how we perceive these. However, Kepler is adamant there is nothing non-natural or mystical in his views and says in *Harmonices Mundi*:

Whoever wants to nourish his mind on the mystical philosophy ... will not find in my book what he is looking for.¹¹³

Even if we take the passages above to be genuine and to be about astrology, there is no need to attribute any non-natural belief to Philolaus.

I have argued that there is no credible evidence that Philolaus subscribed to the theory of metempsychosis. There is little to suggest that he was interested in astrology and nothing to suggest that if he was, this involved any non-natural belief. There seems to be nothing that is mystical in Philolaus' thought. The real issue here is that of numerology, in both music theory and in cosmology. That we will look at in some more detail once we have looked at the nature of numerology and its historiography more generally.

Archytas

Archytas of Tarentum was born around 428 BCE and lived to around 347 BCE. He was important for his work in mathematics, cosmology and music theory and was also active as a political leader. We have no work that has survived as a whole, with only a few fragments having come down to us, though they are important and there is a good deal of significant testimonia.¹¹⁴ There has been some question on whether Archytas should be treated as a Pythagorean, as there is nothing in his work about metempsychosis, but Plato clearly does treat Archytas as a Pythagorean when he says:

As our eyes are suited to astronomy, so our ears are suited to harmony, for these are sister disciplines, as the Pythagoreans say and we, Glaucon, agree.¹¹⁵

Apart from a similar grouping of the sciences to Archytas, Plato uses the term *adelphos* to express their relationship, as does Archytas in fragment 1. There is also a question of whether Archytas should be treated as a presocratic in the strictest sense as the historical evidence is that he was a contemporary of Plato.

I will pass over Archytas' work in mathematics and cosmology relatively rapidly. Excellent accounts of these can be found in Huffman.¹¹⁶ We will look at his work on music in a little more detail as there is an important contrast to be drawn with the work of Philolaus. In what follows, several things are of importance. Firstly, there is no trace in Archytas of the idea of metempsychosis. Not only is there no direct mention of this idea, there are no passages or fragments which might be thought to allude to it either. It is quite simply absent from Archytas on the evidence we have. Second, there is no hint of mysticism in Archytas' work either. Indeed, Archytas is concrete in

everything he says and he regards logistic as the key science. So in Fr. 1 we find him saying things like:

It seems to me that those concerned with the science make distinctions well and it is by no means surprising that they understand individual entities as they are. Having made good distinctions concerning wholes they are also able to see well how things are according to their parts. Concerning geometry, arithmetic and sphaerics they gave clear distinctions and not least concerning music. These sciences seem to be akin.¹¹⁷

In Fr. 4 we find him saying:

It seems that logistic is far better than the other crafts in respect of wisdom and deals with its topics more concretely than geometry. In those ways in which geometry is lacking, logistic utilises demonstration.¹¹⁸

Third, there are no criticisms of Archytas like those of Heraclitus or Pythagoras, there are no stories of strange powers or deeds associated with Archytas and no one has suggested that Archytas was a shaman. Finally, I will argue that numerology is also absent from Archytas' thought.

Archytas, mathematics and cosmology

We have a very interesting thought experiment concerning the finite nature of space from Archytas.¹¹⁹ What would happen if someone standing at the limit of a finite cosmos thrust a staff beyond the limit of the cosmos? If he can, and our intuition would seem to be that he can, then this is not the limit of space, and we have a new limit. The thought experiment though is replicable, so wherever a new limit is supposed we can imagine someone thrusting a staff beyond it. Therefore space is unlimited. This argument was much discussed in antiquity and there are replies, such as that it is impossible to stand at the edge of the cosmos, or more subtly, outside the cosmos there is neither time nor space so there is nowhere to thrust the staff. All I want to point out here is there is no sense of mysticism or an extended world in Archytas' work here. His comments on cosmology are also free from any sense of numerology.

Archytas produced a solution to the Delian problem, of doubling the volume of a cube.¹²⁰ Archytas built on the work of Hippocrates of Chios. If L is the length of the original cube, it is possible to set up a series of ratios such that $L:a :: a:b :: b:2L$.¹²¹ It is then possible to derive the relation $L:2L = L^3:a^3$. As $L^3:a^3$ is in the ratio of 1:2, a^3 is twice L^3 , and the cube can be built with sides of length a . Archytas' solution, which is too complex to give in full here, involved constructing four similar triangles in the proportions suggested by Hippocrates by an imaginary rotation of triangles and calculation of their points of intersection.

Archytas demonstrated one very important property of what are known as superparticular ratios, which were important in Pythagorean musical theory. These superparticular ratios were of the type where $n+1:n$. Now if x bears the same

proportion to y as y does to z , then y is the mean proportional of x and z (if $x:y :: y:z$). This is important for Pythagorean musical theory, as a double octave (4:1) can be split into two octaves with a mean proportional as 4:2 is the same proportion as 2:1. Archytas though managed to demonstrate that there is no mean proportional for numbers in superparticular ratios. This means that critical musical ratios, such as 3:2, 4:3 and 9:8 (which all have the form $n+1:n$) have no mean proportional and cannot be split into two equal parts.

I offer this snapshot of Archytas' mathematical work to give a sense of the sort of problems he worked out and the way he went about solving these problems. These are specific mathematical problems to which Archytas has concrete solutions and there is no sense of anything mystical or non-natural in this work

Archytas and music theory

Archytas' work on music theory builds on that of Philolaus. Archytas also had a physical theory of pitch.¹²² The pitch of a sound on this theory is related to how quickly it travels, a sound travelling more quickly being of higher pitch.¹²³ Archytas produced a variation on Philolaus' diatonic musical scale, using 9:8, 8:7 and 28:27 to determine the notes up to the fourth ($9/8 \times 8/7 \times 28/27 = 4/3$). Archytas also worked on two other types of scale, known as the chromatic and the enharmonic. A chromatic scale includes all twelve semi-tones.¹²⁴ The key ratios for Archytas' chromatic scale are 32:27, 243:224 and 28:27 ($32/27 \times 243/224 \times 28/27 = 4/3$). In the chromatic scale, $A^\sharp = B^b$. In an enharmonic scale this is not so, and what we would call $A^\sharp$ differs from B^b . The key ratios for Archytas' enharmonic scale are 5:4, 36:35, 28:27 ($5/4 \times 36/35 \times 28/27 = 4/3$).

Diatonic	9:8	8:7	28:27
Chromatic	32:27	243:224	28:27
Enharmonic	5:4	36:35	28:27

In contrast to Philolaus, who seems to be generating in some ways an ideal scale, using only numbers directly related to the tetraktys, Archytas is now generally agreed to have been describing the scales in use during his time.¹²⁵ He may be the target of Plato's criticism at *Republic* 531aff. that some people

Seek to find numbers in these heard concordances, but they do not ascend to problems and thinking about which numbers are concordant and which not and in each case why.¹²⁶

I agree with Huffman that Archytas is a reasonable target for Plato here as Plato will want more in terms of relation to some ultimate good than Archytas will be able to supply, even if Archytas has some mathematical reasoning behind the ratios he uses.¹²⁷

There is no hint of the idea of metempsychosis in any of Archytas' work. There is no suggestion of any mysticism and indeed the whole set up of his thinking with 'logistic'

as the master science would militate against that.¹²⁸ Archytas would also seem to be immune from any accusation of numerology. Certainly there is no trace of numerology in his thinking about cosmology. Nor, in distinction to Philolaus, is there any numerology in his thinking about musical theory either.

Cleansing Pythagoras and Pythagoreanism?

One issue that needs to be addressed before I close this chapter is whether, in the words of Kingsley, I have attempted to

Clean up the image of early Pythagoreanism and present Pythagoras himself as a philosopher who is more or less respectable in modern terms.¹²⁹

Certainly that is not the intention of this chapter. As I said in the introduction to this book, it is not the aim of this work to attempt to cleanse the orthodox canon of presocratic philosophers of any taint of magic or the non-natural. Rather, I am interested in the evidence and how we analyse it. For Pythagoras himself, I think the evidence is inconclusive. I am not convinced that Pythagoras was a philosopher at all on the evidence of Plato or Aristotle, though perhaps that is better put as Pythagoras not being primarily a philosopher. One can certainly make the case that some Pythagoreans believed in an extended world with a possible realm of the dead and souls previously incarnated in humans now incarnated in animals. I think Kingsley makes an interesting case for magic, ritual and access to the realm of the dead among the early Pythagoreans. How deeply held and how widespread that was among such a diverse group as the early Pythagoreans is difficult to tell. However, as we saw with Philolaus and Archytas this does not apply to all the early Pythagoreans. How many, we simply have no way of telling.

Conclusion

The state of the evidence concerning Pythagoras makes it very difficult to draw any precise and concrete conclusions about him. In the post-Burkert era, the picture of the master originator in mathematics, cosmology and music theory has gone, replaced by someone more interested in the fate of the soul and ritual. The new picture need not exclude elements of mathematics, cosmology and music from Pythagoras though but it is still an open question how much Pythagoras contributed to these areas and how much he fostered or inspired research into these areas. Whether Pythagoras himself believed in anything non-natural must also remain an unresolved question. Metempsychosis may involve a belief in the non-natural but does not necessitate it. Pythagoras may well have been a charismatic religious leader and as such might be compared to a shaman, but his belief in metempsychosis seems to rule out the idea of an accessible spirit realm for him. What should hopefully be evident is the truth of Zhmud's comment about the early Pythagoreans, 'how unique they all were'.¹³⁰ There

seems to be no body of doctrine for the early Pythagoreans. Quite possibly some held non-natural interpretations of what they thought were Pythagoras' ideas while others did not.

What I think we can say quite categorically is that on the evidence we have, Archytas had no belief in the non-natural. There is nothing in his views on mathematics or science to indicate such a belief, there is no trace of metempsychosis in his views and his approach to musical theory seems to avoid even numerology. Philolaus is in some ways the most interesting case. The evidence for a belief in metempsychosis and astrology is thin and even if he did have such beliefs there are plausible natural interpretations of those beliefs.

In looking at Pythagoras, Philolaus and Archytas I do not want to present a linear development of Pythagoreanism from the primitive, non-natural views of Pythagoras through to the rational, mathematical science of Archytas.¹³¹ To begin with, I am not convinced that we can ascribe those sorts of ideas to Pythagoras with any confidence given the current state of the evidence. Second, I do not take Philolaus or Archytas to be representative of the Pythagoreanism of their period or even to be typical Pythagoreans of their period. I have little doubt that there were Pythagoreans of their times who believed in the non-natural and certainly there were Pythagoreans after them who believed in the non-natural. I have talked about them here partly because they are the people we have the most information on and partly because they are good examples for the purposes of this chapter and book. If we accept Archytas as a Pythagorean and accept that his work had no non-natural element to it at all, which is what the evidence would seem to indicate, then we cannot move from 'x was a Pythagorean' to 'x held non-natural beliefs'. Philolaus too is an interesting battleground where the balance of the evidence is that he held no non-natural beliefs either. So this chapter is in a sense a microcosm of this book. Where this book asks how many presocratics held entirely natural beliefs, this chapter has effectively asked the same question about the Pythagoreans.

The Early Pythagoreans and Numerology

In this chapter, I want to examine the nature of numerology in some more detail as well as the character of early Pythagorean beliefs in numerology. Definitions of numerology can be quite diverse and it is by no means clear that a belief in numerology entails a belief in the supernatural. As with the ancient astrology and ancient alchemy we looked at earlier in the book, ancient numerology can differ very significantly from its modern counterparts. Burkert has been strongly critical of the early Pythagoreans. I disagree with Burkert that Pythagorean numerology ought to be classified as 'primitive'. I will argue that between what might be called number superstition, common to many early cultures, and the modern conception of the relationship of mathematics to science and the world, there were many interesting possibilities to pursue for how numbers relate to nature. There is a quite distinct nature for these possibilities and they are not continuous with Burkert's notion of 'primitive' numerology. This is in line with one of the main themes of this book. We should look at magical disciplines as a spectrum with many interesting possibilities between the supernatural and the mystical at one end and the scientific at the other end. A bipolar approach, making a radical separation of magic and science is not historically helpful. In the final part of this chapter I will look at Plato's relation to the Pythagoreans. There are various reasons for doing this. First, by distinguishing Plato from the Pythagoreans, we can get a sharper focus of Pythagorean beliefs. There has been a tendency for Plato and the Pythagoreans to be grouped together under the headings of numerology and 'number mysticism' when in fact there are some interesting and important differences between their views on the role of number. In studying Plato we get a further example, distinct from the Pythagoreans, of how number may relate to the world outside of primitive numerology and modern ideas of mathematical physics. Finally, I hope to argue that the reasons why Plato employed number in certain ways may help to throw light on the way that the Pythagoreans employed number. There were important philosophical motivations for Pythagorean numerology which make their use quite different from 'primitive' numerology.

Burkert on numerology

Burkert takes the view that the early Pythagoreans are indeed guilty of numerology and that the numerology they practised was far removed from mathematical science.¹ While he accepts that number dominated the world view of the Pythagoreans and that they investigated the relations between numbers and between number and musical harmony, he asks:

Do we not see here, in epitome, the origin and basis of natural science? To this question we must answer no. Number and mathematical science are by no means equivalent.²

Burkert is of course correct to assert that number and mathematical science are by no means equivalent. We use numbers to quantify the world, we feed those quantities into equations and we subject those equations to experimental testing. He comments that, quoting Levi-Bruhl:

In primitive cultures, numbers are not abstract concepts with a content which is mathematically and quantitative, but mysterious beings. Each number has its own individual physiognomy, a kind of mystic atmosphere, a 'field of action' peculiar to itself.³

Burkert runs through the numerological beliefs of several early cultures⁴ and then looks at some numerological beliefs from Greece prior to the Pythagoreans,⁵ concluding that the ideas of numbers being characterised in terms of male, female and marriage etc. is a far older type of belief, one which he categorises as 'pre-logical'.⁶ He goes on to say that:

The notion that numbers have a 'metamathematical' cosmic significance, and that they reveal the principle of the order of the world and of human life, is not any kind of scientific or philosophical insight, but a readily comprehensible characteristic of pre-mathematical thinking about number. Pythagorean number symbolism is therefore much older than any natural, science mathematics or astronomy that Pythagoras or his pupils could be imagined to have practiced.⁷

While I agree with Burkert that there are aspects of Pythagoreanism which are continuous with previous speculation about number, I believe his view to be overly harsh and to be based on an unjustifiable bifurcation of 'primitive' number superstition and mathematical science.⁸

The language in which we express modern physics is a mathematical one, where we express its laws by means of mathematical equations. This has become so natural that it is easy to assume that it has always been evident that physical laws could and should be written in this manner. This is not the case, and it is only since the seventeenth century that we have expressed physical laws in this way in any sort of consistent manner. Prior to that many different ideas for the relation of number to the world were open possibilities. The Pythagoreans, I argue, pursued some of those possibilities. I am quite happy to accept with Burkert that many early cultures had number superstitions,

such as lucky and unlucky days, etc., and that some of this thinking is continuous with Pythagorean ideas. I am also happy to accept that in some cases early cultures applied mathematics to their observations of the heavens and were able to produce useful and accurate predictions of the movements of the heavens.

What we find in the Pythagoreans but not in other early cultures is the attempt to apply what are thought to be certain privileged numbers, the tetraktys of 1, 2, 3 and 4 or the perfect number 10 generated from the tetraktys to draw conclusions about the nature and structure of the heavens or the world. So there are 10 bodies in the heavens because that is the perfect number and their motion is related to the tetraktys because that is related to the celestial music. In musical theory, Philolaus' scale is based on numerological considerations as the scale derives entirely from the numbers involved in the tetraktys. This is in contrast to Archytas, who is generally reckoned to have tried to supply numbers for the scales that ancient musicians actually played rather than produce a scale which is number driven, which appears to be the case with Philolaus.

There is a second issue here and that is one of motivation. Is the motivation for Pythagorean numerology similar to that of earlier cultures or different from it? Later on in this chapter I will argue that the motivation for some Pythagorean numerology is philosophical, based on how the structure of the cosmos can be good and how we can know things about the cosmos. This is radically different from the motivation of earlier cultures. Let us take a final thought on Burkert's position. He comments that:

Plato thought it an inescapable conclusion that the orderly motion of the stars is due to their having souls; it is a voluntary, chosen order. Here sophisticated Greek science harks back to the pre-scientific way of thinking and comes to rest in it.⁹

This is a view which I have strongly disagreed with elsewhere.¹⁰ I don't see this as a retrograde step but rather as an alternative, interesting and well-motivated way of thinking about the order of the heavens. What this comment illustrates though is that Burkert had a rather bipolar, black and white view of this sort of issue. Either something fitted with his (rather narrow) conception of science or it fell back into pre-scientific thinking.

Modern numerology

I wish to clear one conception of numerology out of the way first. There are people in the modern world who describe themselves as 'Pythagorean numerologists'.¹¹ Usually, this means a combination of two things. First, there is the practice of isopsephy, also sometimes called gematria, where numbers are substituted for letters typically in a person's name, typically by a simple $a = 1$ and $b = 2$ substitution. Those numbers are then manipulated (typically by an addition process until a single figure is reached) to give key numbers. Second, numbers are given characteristics, such that the key numbers arrived at can be interpreted as diagnostic of a person's character or of their future. Such numerologists will often claim ancient roots for their practice in Pythagoras or the kabbalah.¹² Typically, the number manipulations aim at producing

several single digit numbers. So for the hypothetical Alan Aard, born 01/12/1993, one numerological computation might be:

Alan: $1 + 12 + 1 + 14 = 28 = 10 (2 + 8) = 1 (1 + 0)$

Aard: $1 + 1 + 17 + 4 = 23 = 5$

01/12/1993: $1 + 3 + 22 = 26 = 8$

So Alan Aard has the key numbers of 1, 5, 8.

So if, e.g., 1 = Determination, 5 = Harmony, 8 = Balance, then Alan Aard, born 01/12/1993, is determined, harmonious and balanced.

The details of this procedure are quite arbitrary and the manipulation of the numbers can be done in many ways to produce the key numbers. The manipulation can be made more complex and the interpretation of the key numbers made more complex to give the numerologist an air of expertise or mystery, but the basic principles remain the same.¹³ Isopsephy in various forms was known in the ancient world, but we have no evidence linking it either to Pythagoras or any early Pythagorean. The early Pythagoreans were simply not numerologists of this sort, however much modern numerologists would like to give their practice ancient authority by linking it to them. With this sort of numerology one can give a definition like:

Numerology is the study of the occult meanings of numbers and their influence on human life.¹⁴

One can follow that up with criticism like:

Numerology shouldn't be brushed off without a thorough examination of its underlying theory. Unfortunately, there doesn't seem to be any.¹⁵

In the introduction to this book, I said that modern numerology was a nonsense both theoretically and empirically and this was the sort of numerology I had in mind there. However, this sort of numerology is not exhaustive of all the practices which might be termed numerological, either in the modern world or for the Pythagoreans.

Distinguishing mathematics from numerology

Is the distinction between mathematics and numerology or mathematical physics and numerology evident, either philosophically or historically? Stove has commented that:

No one actually knows, even, what is wrong with numerology. Philosophers, of course, use numerology as a stock example of thought gone hopelessly wrong, and they are right to do so; still, they cannot tell you what it is that is wrong with it. If you ask a philosopher this, the best he will be able to come up with is a bit of Positivism about unverifiability, or a bit of Popperism about unfalsifiability.¹⁶

The unverifiable/unfalsifiable approach may well be effective against the modern 'Pythagorean' numerologists, but it is quite possible to reformulate some numerological ideas such that they lead to verifiable or falsifiable consequences. It is then much less easy to define what is numerological. This is not to say that it cannot be done, but as with many similar issues, producing a clear and watertight definition is not straightforward and our initial intuitions on the issue may prove false or difficult to formalise.

Is the distinction between mathematics and numerology or mathematical physics and numerology historically evident? Some important ideas for modern science were criticised as numerological when they were introduced. An interesting example here is the periodic table of elements. Early attempts to sort the elements into eight groups were criticised as numerological, though the comment from one of the early proponents, Newland, who said that nature obeys the law of the octave did little to deflect such criticism. Mendeleev's table (formulated in the 1860s and 1870s and much less sophisticated than the modern table of elements which is based on it) also came in for criticism, sorting the elements into eight groups, based on chemical similarities. Some of this appeared arbitrary as Mendeleev did not order according to atomic weight and left gaps where he thought there should be an element with certain properties, but no such element was as yet known.¹⁷ Was research into new elements going to be determined by the unexplained mathematical patterns of Mendeleev table?

There is also a theory in modern theoretical cosmology known as the large number hypothesis. There are several ways of combining various fundamental constants together such that the result is a figure in the order of 10^{40} .¹⁸ Is this a coincidence and is fetishising 10^{40} and using it as the basis for further calculations mere numerology?¹⁹ Or does the large number hypothesis reflect something deep and important about the nature of our universe? The large number hypothesis is currently far from mainstream cosmology, but work is still occasionally done on it in the hope that it may shed some light on the fundamental problems of cosmology.²⁰ There are also some theories in the mathematical modelling of economics which have been accused of being numerological, or being too close to numerology.²¹

One can try to define numerology by saying that it attributes non-mathematical properties to numbers. One would then have to discuss what are and are not mathematical properties. This definition misses a key issue though, which is not so much the properties that numbers have in themselves, but how numbers are used in the sciences. If we try to define numerology as assigning an undue physical significance to numbers, the nature of 'undue' will then come under scrutiny. As we have seen it is neither philosophically nor historically clear in all cases what is undue significance.

A related issue is the question of aesthetics in science where theory choice for some scientists is a question of selecting the most aesthetically pleasing formalism. The cynical view here would be to suggest that when a mathematical relationship is proposed which is eventually accepted by the scientific community, the proposer is praised for their deep insight and intuition in mathematical physics. When a mathematical relationship is proposed and is rejected, the proposal is castigated as numerological.²² One would hope that there is something more principled than that involved, but it is hard to specify exactly what.

Do numbers have properties?

Attempts to define numerology by saying that it gives characteristics or properties to numbers where mathematics does not runs into a major obstacle very quickly. Numbers do have properties. At the most basic level, integers are either odd or even and some but by no means all integers are prime numbers. Prime numbers are fundamental to some important mathematical theorems and have some very odd properties themselves.²³ If we want a slightly surprising property of numbers, which was certainly known to the Pythagoreans, there is the fact that, loosely put, the sums of odd numbers give the square numbers. Put more precisely, the sum of the first n odd numbers = n^2 . So:

$$1 = 1 = 1^2$$

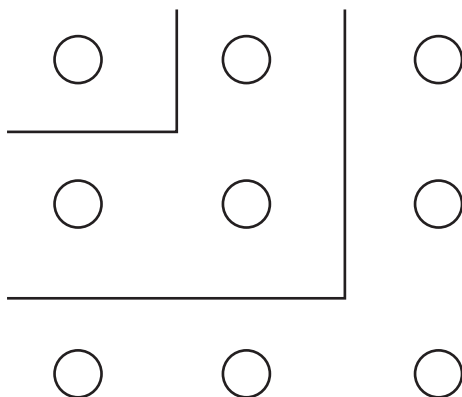
$$1 + 3 = 4 = 2^2$$

$$1 + 3 + 5 = 9 = 3^2$$

$$1 + 3 + 5 + 7 = 16 = 4^2$$

$$1 + 3 + 5 + 7 + 9 = 25 = 5^2$$

This can be expressed graphically like this:



Some numbers are 'perfect' numbers where 'perfect' is a technical term and the number is equal to the sum of its factors. The number 6 is divisible by 1, 2, and 3.

$$6 = 1 + 2 + 3, \text{ making } 6 \text{ a perfect number.}$$

There is a sequence of perfect numbers, the next being 28:

$$28 = 1 + 2 + 4 + 7 + 14$$

The next two are 496 and 8128 and there are currently 47 known perfect numbers. The Pythagoreans were aware of the idea of perfect numbers and had the terms 'under-perfect' and 'over-perfect' for numbers whose factors added up to less or more than the number respectively.

If we want an odd property based on adding numbers together, here is the quick way to decide if a large number is divisible by three. If the sum of the digits of the large number are divisible by 3, the number itself is divisible by 3. So, e.g.:

191 = 11, not divisible by 3

192 = 12, divisible by 3

26,724 = 21, divisible by 3

Finally, a relation between numbers which is arguably interesting, marvellous, strange and hidden, though for each of those attributes one might well ask whether they are absolute or relative to the observer (or relative to the level of mathematics the observer has!). Euler's identity states that:

$$e^{i\pi} + 1 = 0$$

Where:

e is the base of the natural logarithm

i is the square root of -1

π is the ratio of a circle's circumference to its diameter

That there is such a simple and elegant way of relating such three hugely important and useful irrational numbers as e, i and π I have always found quite remarkable. So numbers have properties and some of those are interesting, marvellous, strange and hidden, at least to me. None of this is to defend numerology. What I want to point out here is that there is a considerable breadth of numerological practices, ranging from psephology/gematria through to practices close to mathematical physics which are deemed to be too much driven by mathematical or aesthetic considerations. The distinction between mathematics and mathematical physics on the one hand and numerology on the other is not straightforwardly evident to us, nor historically has it been evident to those in the past.

Definitions of numerology

It will be clear from the preceding section that there are many forms and guises of what can be called numerology, so it will be wise to try to clarify what sort of numerology we are dealing with in relation to the early Pythagoreans. I will call one sort of numerology 'associative numerology'. This sort of numerology associates numbers with good or bad times to do things, with good or bad luck, etc., or even with ideas such as justice or marriage. This is the sort of numerology that Burkert terms 'primitive' and attributes to the Pythagoreans as well. I am trying to avoid pejorative terms here like 'primitive' or 'superstitious' numerology, though one can easily see how they might be applied. One reason for avoiding 'primitive' as a term is that this sort of numerology is still quite common even today. To a certain extent I agree with Burkert in that we can find this sort of numerology in the early Pythagoreans, even if they make use of other forms of astrology as well.

Some use the term 'arithmology' to refer to numerology done with the first ten numbers. I won't be using this term as I don't think it is helpful in dividing up the various kinds of numerology and in particular I don't find it helpful in thinking about

the Pythagoreans.²⁴ All it does is separate the Pythagoreans without saying anything concrete or informative about the nature of the numerology that they are doing.

There is also number symbolism where numbers are held to be symbolic of some concept, representing such ideas as marriage and justice. Often used in close conjunction with number symbolism is the term 'number mysticism'. As with many terms involving the word 'mysticism', it is not easy to give a tight definition. Number mysticism though is often related to idea that numbers have some hidden power or that the properties of number are real but inexplicable. One might differentiate number mysticism from other forms of numerology on the basis that number mysticism gives no explanation why some numbers are more significant than others. Some Pythagorean numerology is then not number mysticism because it can give an account of why a number is significant, such as 10 being the sum of the tetraktys numbers.

I will call the sort of numerology to do with calculations based on names, words or dates isopsephic numerology. As we have seen there is no evidence that the Pythagoreans practised this form of numerology, but it is important to distinguish this from other forms of numerology.

Finally, I will also call one sort of numerology 'cosmic' numerology where numbers which have some form of privileged status are used to try to understand the nature and structure of the cosmos or of phenomena within the cosmos. This differs from modern mathematical science in the use of privileged numbers. One way of putting the contrast here is to say that modern science recognises that we can apply numbers to the world but is indifferent to which numbers we apply and which numbers we in fact apply are determined empirically. Cosmic numerology applies privileged numbers to the world based on a priori considerations. This distinction may not be as clear cut as it first appears as modern science, while it may not privilege particular numbers, certainly privileges certain mathematical techniques, though one may argue there is a good empirical basis for that. One advantage of this definition is that numerology is not simply failed mathematical science but has some methodological differences. That raises the possibility that a numerological approach might actually get a correct answer, even if for the wrong reasons!

Pythagorean numerology

What form then did Pythagorean numerology take? Here I want to concentrate on what I have called cosmic numerology, with the application of privileged numbers to music and cosmology and I will come back to the broader question of Pythagorean numerology a little later on. It is worth noting to start with though that the Pythagoreans were aware of some mathematical properties of numbers and of some relations between numbers, such as odd and even, and the relation of the odd numbers to the square numbers.²⁵

As noted in the previous chapter, there is an important difference between the work of Philolaus and that of Archytas on music theory. Philolaus seems to be attempting

to produce some form of ideal mathematical relationships, using only the privileged numbers based on the tetraktys. We can represent the Philolaus scale like this:

1	9/8	81/64	4/3	3/2	27/16	243/128	2
	9/8	9/8	256/243	9/8	9/8	9/8	256/243
C	D	E	F	G	A	B	C

Each number here is based on a tetraktys number. So 9/8 is $3 \times 3 / 2 \times 2 \times 2$, 81/64 is $9/8 \times 9/8$, 27/16 is $3 \times 3 \times 3 / 2 \times 2 \times 2 \times 2$, and even the arbitrary looking numbers as 128, 256 and 243 are powers of 2 and 3; $128 = 2^7$, $256 = 2^8$ and $243 = 3^5 (= 3 \times 81, \text{ when } 81 = 3 \times 27 \text{ and } 27 = 3^3)$.

So certain numbers are privileged by either being part of, or directly derivable from, the tetraktys. This is not the case for several of the ratios which Archytas uses, such as 8:7, 28:27, 32:27, 243:224, 5:4 and 36:35. Philolaus then had a numerological approach to music theory.

The second key issue here is that of the 'harmony of the spheres'. Aristotle gives us several passages on the Pythagoreans and music in the heavens. He tells us in the *Metaphysics*:

Since, again, they saw that the modifications and the ratios of the musical scales were expressible in numbers; – since, then, all other things seemed in their whole nature to be modelled on numbers, and numbers seemed to be the first things in the whole of nature, they supposed the elements of numbers to be the elements of all things, and the whole heaven to be a musical scale and a number. And all the properties of numbers and scales which they could show to agree with the attributes and parts and the whole arrangement of the heavens, they collected and fitted into their scheme; and if there was a gap anywhere, they readily made additions so as to make their whole theory coherent. E.g. as the number 10 is thought to be perfect and to comprise the whole nature of numbers, they say that the bodies which move through the heavens are ten, but as the visible bodies are only nine, to meet this they invent a tenth — the 'counter-earth'.²⁶

Aristotle tells us in *On the Heavens*:

From all this it is clear that the theory that the movement of the stars produces a harmony, i.e. that the sounds they make are concordant, in spite of the grace and originality with which it has been stated, is nevertheless untrue. Some thinkers suppose that the motion of bodies of that size must produce a noise, since on our earth the motion of bodies far inferior in size and in speed of movement has that effect. Also, when the sun and the moon, they say, and all the stars, so great in number and in size, are moving with so rapid a motion, how should they not produce a sound immensely great? Starting from this argument and from the observation that their speeds, as measured by their distances, are in the same ratios as musical concordances, they assert that the sound given forth by the circular movement of the stars is a harmony. Since, however, it appears unaccountable

that we should not hear this music, they explain this by saying that the sound is in our ears from the very moment of birth and is thus indistinguishable from its contrary silence, since sound and silence are discriminated by mutual contrast. What happens to men, then, is just what happens to coppersmiths, who are so accustomed to the noise of the smithy that it makes no difference to them.²⁷

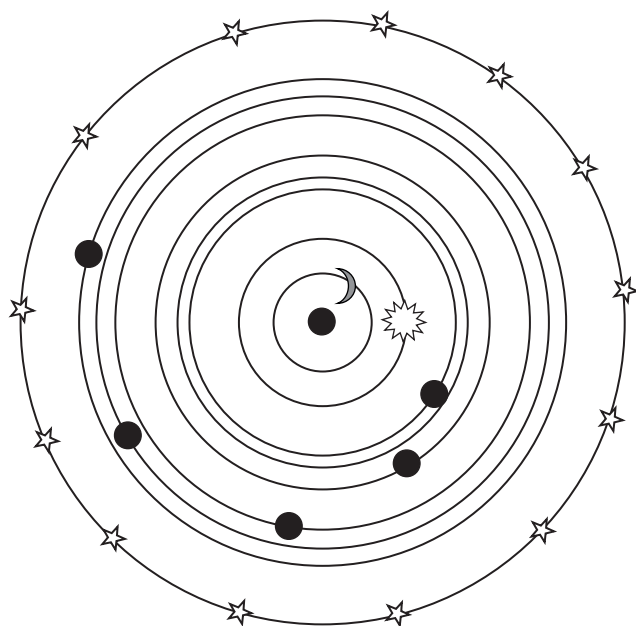
We also have Aristotle Fr. 13:

For the bodies that move round the centre have their distances in a certain proportion, and some move faster and others slower, and in their movement the slower make a low-pitch sound and the faster a high-pitch sound, and these notes, being proportionate to the distances, make the resultant sound harmonious. And since they said that number was the first principle of this harmony, they naturally made number the first principle of the heavens and of the universe. For they thought the sun to be, say, twice as far from the earth as the moon, Venus to be three times as far, Mercury four times, and each of the others to be in a certain arithmetical ratio, and the movement of the heavens to be harmonious, and the bodies that move the greatest distance to move the fastest, those that move the least distance the slowest and the intermediate bodies to move in proportion to the size of their orbit.²⁸

The general outline of this is clear enough. According to Aristotle, there is some form of music in the heavens and the counter-earth is added to make a tenth entity. 'Spheres' in 'harmony of the spheres' is something of a misnomer as there are no spheres in Pythagorean cosmology. What then, is there a harmony of? It is probably best thought of as a harmony of the orbits. One reason for that is that it solves a counting problem. If we follow Aristotle and say 'bodies' in the heavens there is the problem that the stars cannot be counted as a single body, leaving the Pythagoreans with eight and not nine bodies and the addition of one more to make nine, rather than ten, as a nonsense. One good reason for this is that this is how the stars are taken in Plato, in the *Republic's* Myth of Er which has the stars as a single entity for the purposes of the music of the heavens. The *Republic's* Myth of Er gives us a picture of the heavens as a spindle (616c ff.), and provides the following information:²⁹

Position	Object	Appearance	Band width	Speed (vs. stars)
Outermost	Fixed stars	Spangled	Broadest	N/A
2nd	Saturn	Yellow	8th	5th
3rd	Jupiter	White	7th	4th
4th	Mars	Ruddy	3rd	3rd
5th	Mercury	Yellow	6th	2nd =
6th	Venus	2nd whitest	2nd	2nd =
7th	Sun	Brightest	5th	2nd =
Innermost	Moon	Lit by 7	4th	Fastest

The width of the rims of each of the bowls in the spindle is most plausibly interpreted as a reference to the relative distances of the planets.



Plato also tells us that:

The spindle turned on the knees of Necessity, and up above on each of the rims of the circles a Siren stood, borne around in its revolution and uttering one sound, one note, and from all the eight there was the concord of a single harmony.³⁰

There are two aspects of orbits for the Pythagoreans which might display harmony. Their sizes, measured either as distances from the centre or as circumferences might be in some harmonic ratio, or the speeds of the orbits might exhibit harmony. The third Aristotle passage here suggests something stronger, which is both, with the speed of the orbit related to the size of the orbit. That is a rather stronger claim and whether it could actually be made to work might be open to question. Unfortunately, Aristotle is rather vague in the figures he gives here.

Can the heavenly *harmonia* be traced to any specific Pythagorean? Aristotle does not mention anyone by name, and we do not have direct evidence of any Pythagorean holding this view. Attempts have been made to keep Philolaus clear of the heavenly harmony view. Against that, I would point out two things. First, although Aristotle does not mention Philolaus by name his comments on celestial harmony are in the context of a tenth celestial entity, the counter-earth and that looks very much like Philolaus. Second, Philolaus does use the word *harmonia* in describing the cosmos. While this may simply mean a fitting together, it can also have a stronger sense of a musical fitting together and that at least gives a basis for a belief in celestial harmony.

This section has concentrated on Pythagorean cosmic numerology in order to show that such a thing existed and to look at some of its details.³¹ That it exists is important as it is different from the associative numerology of previous cultures. The

next few sections of this chapter will try to emphasise that point by looking at some of the philosophical issues the Pythagoreans were trying to address by employing cosmic numerology. That will be important because one might argue that the application of privileged numbers to the cosmos is simply an extension of associative numerology. If there are specific philosophical reasons for applying privileged numbers to the heavens, quite separate from associative numerology, then we have something beyond associative numerology.

Plato and number

In order to try to understand what at least some of the early Pythagoreans were doing with number, it is useful to look at Plato.³² Plato provides a different example of early attempts to think about how mathematics and the world relate to each other, it is important to differentiate between Plato and the Pythagoreans and Plato's reasons for his use of mathematics may throw some light on the Pythagorean project.

I take the view that while Plato was influenced by some aspects of Pythagorean thinking, Plato was not himself a Pythagorean³³ and it is inappropriate to describe any of his works as Pythagorean either.³⁴ Plato rejects the notion of the soul as a harmony.³⁵ In terms of cosmology, there are specific differences with Archytas and Philolaus. The cosmos of the *Timaeus* is finite and bounded where Archytas argued for an infinite, unbounded cosmos.³⁶ The *Timaeus* has a radically different account of the number, nature, motions and organisation of the celestial bodies from that of Philolaus.³⁷ There are two other important structural differences between Plato and the Pythagoreans in approaching cosmology.

One can broadly categorise the Pythagorean approach as arithmetical.³⁸ That is they were interested in the relation of numbers to the world. This could be termed an arithmetical cosmology. Plato on the other hand had a more geometrical conception of the cosmos. There are the 1, 1, $\sqrt{2}$ and 1, $\sqrt{3}$, 2 triangles from which the cubes of earth and the tetrahedra, octahedra and ikosahedra of fire, air and water are formed. It is these shapes which form the basis of Plato's cosmos, not numbers themselves. Aristotle is critical of Plato for what he takes to be the arbitrary way in which Plato allows his analysis of the elements to end at triangles when it could have gone further to lines and points.³⁹

A second issue is the derivation and conception of the musical scale. Philolaus' scale uses the tetraktys of 1, 2, 3, and 4 to generate its ratios, the justification being that $1 + 2 + 3 + 4 = 10$, the Pythagorean perfect number. So the justification here is numerical. The notes are then generated from the ratios of these terms. Similarly, we might note Aristotle's criticism that the Pythagoreans assume there to be 10 celestial bodies (earth, moon, sun, 5 naked-eye planets, counter-earth, central fire) on the basis that 10 is the perfect number and so there should be 10 celestial bodies.⁴⁰ While the Pythagoreans have ten heavenly bodies, Plato simply accepts there are seven heavenly bodies to (moon, sun, 5 naked-eye planets) and has seven terms as basic to his musical scale (1, 2, 3, 4, 8, 9, 27),⁴¹ which are the relative lengths of the soul stuff which the

demiurge uses to fashion the orbits for these bodies.⁴² Plato then generates a tone and semi-tone scale from these terms.⁴³ Again, the derivation is geometrical (dividing the soul stuff into circles) rather than purely arithmetical as with the Pythagoreans. So while the Pythagoreans have a numerological derivation of cosmology and of music, Plato has a cosmological derivation of music.

One can easily see how ancient commentators would be tempted to find considerable similarities between Plato and the Pythagoreans here, and be tempted to attribute numerological ideas to Plato. One can also see how some modern commentators, in a positivist frame of mind, might take the view that all of this is outside of known scientific methodology and all of this involves some mysterious number juggling. One may then fail to differentiate between the Pythagorean scheme and what Plato is attempting.

These differences are important in relation to a line that can be taken on the relation of Plato, the early academy and Aristotle to the early Pythagoreans. It has been argued that aspects of what is usually taken to be early Pythagorean numerology (emphasis on the number 10, supposition of the counter-earth, application of music theory to the heavens, etc.) were wrongly attributed to the early Pythagoreans by Aristotle.⁴⁴ The true genesis of these ideas is with Plato and the early academy and Aristotle, for whatever reason, then attributes these ideas to the early Pythagoreans.⁴⁵ However, if there are significant differences between Plato's approach in the *Timaeus* and the views which Aristotle attributes to the early Pythagoreans, then that line looks rather less plausible. I do not see the emphasis on the number 10 in Plato,⁴⁶ I do not see the supposition of entities like the counter-earth⁴⁷ and the application of music to the heavens is in a significantly different manner to a significantly different cosmology.

Plato and Kepler

Having pointed out some differences between Plato and the early Pythagoreans, I now want to develop some similarities. As a link between Plato and some early Pythagoreans, I would emphasise not only the *Timaeus* but parts of the *Philebus* as well. Of particular significance for what I will argue are *Philebus* 16c ff. on limit and unlimited, particularly in relation to this being a gift from the gods and fundamental to all discoveries, order and harmony.⁴⁸ I have discussed in more detail elsewhere why Plato and later Kepler used mathematics in their accounts of the heavens.⁴⁹ Plato used the terms of the Philolaus scale to give the spacing of the planetary orbits. Nearly two millennia later Johannes Kepler, a crucial figure on the history of astronomy, used relations between the five Platonic solids (cube, tetrahedron, octahedron, ikosahedron and dodecahedron) to give the ratios between the orbits of the planets in his heliocentric system.⁵⁰ Kepler also manipulated ratios derived from the planet's elliptical orbits to give the music that the motions of the planets acted out.⁵¹ Why did Plato and Kepler approach cosmology in this manner? If we look at the modern view of why there are this number of planets in our solar system, with this distribution of orbits, the answer will be that this is largely a matter of chance. With current models of solar

system formation there is nothing which determines the number, size, spacing or velocity of the planetary orbits. Leibniz' comment on Kepler is very interesting. He said that:

The angels had watched over that he might be the first among mortals to publish the laws of the heavens, the truth of things, and the principles of the gods.⁵²

If a benevolent deity, be it demiurge or Christian god, generates the universe there is nothing which is generated arbitrarily and the benevolent deity has reason for all that it does. So criteria are needed for the number of planets and their distribution into orbits. Plato and Kepler recognise the need for criteria here. Possibilities open to Plato and Kepler, but closed by the developments of the seventeenth century are forms of geometrical or harmonic ordering. This sort of choice is also important for Plato in matter theory. Plato opposes the view of Leucippus and Democritus, where the shapes and sizes of the atoms are *ou mallon*, that is there are no preferred shapes and sizes.⁵³ Plato argued that the demiurge selected the two best types of triangle for the foundations of his geometrical atomism.⁵⁴ There is no mysticism here. Plato gives concrete reasons why the chosen numbers and shapes are best for the cosmos.

I would add two further motivational factors for Plato here. The mathematics does not only give the demiurge criteria to make choices with, those choices make the cosmos good, indeed they are an important part of making the cosmos the best cosmos it could be. There is also an epistemological issue here. If humans are to be able to know something about certain aspects of the cosmos, it is important that there is mathematical structure and that human thought can at least to some extent access that structure.⁵⁵

There is an important further aspect to each of these considerations, which put simply is that the mathematisation of nature on its own is not sufficient for the goals envisaged. In relation to the choices that the demiurge makes, it is not sufficient to have the demiurge impose number and shape on a chaos that previously lacked number and shape. Which numbers and shapes would the demiurge choose? It is necessary that the demiurge chooses the best numbers and shapes to delimit the choice. This in turn is related to the issue of the best cosmos. Clearly a cosmos which is marked out in terms of numbers and shapes will be better than a chaos, but that is not sufficient to make it the best it can be. In order for that to happen, the best numbers and the best shapes, or perhaps the best combination of numbers and the best combination of shapes have to be used. Third, there is the issue of the comprehensibility of the cosmos to human beings. In the modern world, it is enough that we assume that the universe is amenable to mathematical description as we then have the empirical methods to determine which is the appropriate mathematics for the phenomena, whether that be the structure of the solar system or the structure of matter. That is not enough in the ancient world though, whether one thinks of that in terms of a lack of empirical technique or a lack of empirical motivation. For the universe to be comprehensible to humans, it must be structured in the best way with that best way accessible to human beings.

To return to the historical argument here, Kepler's work illustrates that the Renaissance was still struggling with the relation of mathematics and cosmology.

Kepler asked a slightly different question from modern science, but a perfectly rational and reasonable one within his historical context, and one that many others of his time were asking. One can, for instance, contrast the work of Kepler with his contemporary Robert Fludd. Fludd argued that Kepler's work was too concrete and precise.⁵⁶ Kepler himself was adamant that there is nothing mystical in his work, as we have seen. At no stage does he say that anything is inexplicable, rather he is always seeking some form of mathematical explanation. Returning to Plato and the early Pythagoreans, if a major figure in the history of science was still struggling with the relation between mathematics and cosmology nearly 2,000 years later, we can perhaps be a little more sympathetic to their situation. Plato and the early Pythagoreans pursued what to them would have been open possibilities for the mathematical structure of the cosmos, possibilities which were only closed off with the scientific revolution of the seventeenth century. There was nothing irrational, mystical or unsophisticated about those possibilities or their pursuit.

The Pythagoreans and number

What can we take out of this discussion of Plato and Kepler in relation to the Pythagoreans? There is an important difference which is that the Pythagoreans make no reference to a god who has a role in generating the cosmos, so the issues of criteria for the demiurge's choices are not relevant. However, the issues of what makes up the structure of the cosmos and how we can know about the cosmos are. Let us go back to Philolaus Fr. 1 which says that:

Nature in the cosmos was fitted together (*harmochthê*) out of unlimited and limited things, both the whole cosmos and the things in it.⁵⁷

Who or what fitted together the cosmos out of unlimited and limited things in fragment 1 is not an issue here.⁵⁸ What I want to bring out is that there is a difference between a pre-cosmic state and the cosmos for the Pythagoreans. Philolaus Fr. 7 says that:

The first thing to be fitted together (*harmosthen*), the one, is in the middle of the sphere and is called the hearth.⁵⁹

Clearly the key verb here is *harmozô*, to fit together and by doing that out of unlimited and limited things a cosmos comes about. Here we can steer around a scholarly debate on exactly what the unlimited and the limited are and take it that number is somehow implicated here. In order for a cosmos to be a cosmos, it must have this mathematical structure. Whether that is quite as strong as Plato (the single best cosmos has a single, determinable mathematical structure) will depend on how far we push *harmozô*.⁶⁰ I have translated this somewhat conservatively here as 'to fit together', but this word also has a musical sense of to bring into tune, as in to tune an instrument, or even to compose music. It also has a moral sense above simply fitting together (as, say with a carpenter) of an appropriate or suitable fitting together. If we take *harmozô* in these

stronger senses, then the cosmos has not simply been put together, it has been put together in an appropriate manner and has also been brought into tune, which might well entail some form of a harmony of the heavens.⁶¹ If that is a unique harmony, based on the Philolaus scale in turn derived from the tetraktys, then perhaps there is a unique best cosmos for the Pythagoreans. Philolaus Fr. 6 is important here:

Concerning nature and harmony they hold this: The being of objects, eternal being and nature itself are susceptible to divine but not human knowledge, although it is not possible for any of the things which are and are known by us to have been generated as the being of the things out of which the cosmos was put together, both the limited and the unlimited things, did not exist beforehand. However, as these origins did exist and were neither alike nor of the same kind, it would not have been possible for them to have been ordered if harmony had not, in some way, been applied to them. On the one hand like things and things of the same kind were not bonded by harmony, while unlike things, things not of the same kind and things not corresponding in order needed to be closed up tightly in harmony if they were to remain held fast in order.⁶²

We also ought to consider Philolaus Fr. 4 here:

All things which are known have number. Without this, it is not possible for anything at all to be understood or known.⁶³

As with the above discussion about Plato, this sort of thesis can be taken in two ways. The weaker of the two theses is that what is known has number as opposed to having no number. If number is necessary to make things determinate, and things have to be determinate in order to be known then at least one condition for something to be known has been met. We may still have an underdetermination though of which numbers apply in which cases, even though all known things have number. So the stronger view will be that in order for there to be a more secure knowledge, things will have to have number which is determinable by humans. There are important philosophical reasons why the Pythagoreans applied privileged numbers to the cosmos. This aspect of Pythagorean numerology is significantly different from what Burkert has called 'primitive' numerology and what I have called associative numerology. It was different in content, in dealing with music and cosmology and it was different in motivation.

There is an important consequence which follows from this. In order to understand the Pythagorean application of number to the heavens, we do not need to pursue mystical symbolism, numerical symbolism or ideas that this early Pythagorean picture of the cosmos is in some way related to their eschatology as their primary motivations.⁶⁴ These aspects may be there and of course should be duly investigated.⁶⁵ As I have emphasised, I do not claim that cosmic numerology is the whole of Pythagorean numerology. What I do claim though is that their cosmic numerology is philosophically motivated by concerns about what makes a cosmos good and epistemological concerns about how we can know about that cosmos.

Conclusion

The Pythagoreans engaged in a cosmic numerology, with philosophical motivations. While this is far from modern science, it was also significantly different from the primitive numerology of earlier cultures. Burkert was wrong to see Pythagorean numerology as continuous with that of earlier cultures and was wrong to conceive of the application of number to the world as either the sophistication of modern mathematical science or early associative numerology. There were many interesting possibilities between those extremes and the Pythagorean pursued one of them, as others like Plato and Kepler did in their times.

It is important as well that we recognise that cosmic numerology was not the only numerology that the Pythagoreans engaged in. To suggest it was would be to make a great elision and I might justly be accused of attempting to sanitise the Pythagoreans if I did so.⁶⁶ There can be little doubt that the early Pythagoreans also went in for associative numerology and number symbolism. Which of them did and to what extent is probably not retrievable on the current evidence.

I do not wish to argue here that the early Pythagoreans ‘anticipated’ or ‘foreshadowed’ the modern mathematical conception of nature.⁶⁷ I am not arguing that the early Pythagoreans (or Plato, or Kepler) were working towards the mathematical conception of nature and somehow fell short of that, deserving some form of praise for their attempt. I reject the notion that there is (or at least was) a single mathematical conception of nature. There are many, even if the post-scientific revolution success of the modern model has wiped the other possibilities from our reckoning. The Pythagoreans had a mathematical conception of nature. It was different from our modern mathematical conception of nature and was motivated by different questions and different concerns. It was different in turn from other ancient accounts such as that of Plato or later Renaissance accounts such as that of Kepler.⁶⁸ I would also disagree a little with Lloyd’s assessment, that:

While in many contexts the interest shown by Pythagoreans and others in the classification of numbers and in proportions, concord and harmonies reflect ethical, symbolic or aesthetic considerations, in others the theory that ‘all things are numbers’ could and did act as a stimulus to find those numbers, by measurement, in the phenomena.⁶⁹

There was more to the Pythagorean programme than ‘ethical, symbolic or aesthetic considerations’ and the notion that the world can be described by numbers is also a significant move.⁷⁰

There are, or have been, many different types of numerology. Not all of these are the associative numerology or number symbolism that can be found in early cultures. There is much historically interesting ground between the earliest numerology and modern mathematical science. In order to appreciate the ground and where the early Pythagoreans placed themselves, we need to reject the bipolar approach which recognises only modern science and number mysticism and the positivist influence which rejects as meaningless anything which is non-verifiable.

Does this bring the early Pythagoreans back within the presocratic *periphysis* tradition? Certainly it does not bring all of them inside, though it may bring some. I started with the view that the early Pythagoreans held diverse views and hold to that. Some were quite probably interested in metempsychosis and ritual and had little interest in number. Others quite probably were only interested in associative numerology and number symbolism. Some though seem to have a philosophical basis for a belief in cosmic numerology.⁷¹ I am happy that some remain outside the *periphysis* tradition while others do seem to be addressing key issues for the investigation of nature and doing so using entirely natural explanations.

Anaximander?

In Chapter 3 we looked at Anaximander and his use of proportions for the distances to the celestial bodies. I postponed deeper discussion of that until this chapter on numerology. I don't have much to say specifically on Anaximander, I merely point to the discussion of this chapter and ask whether Anaximander did anything problematic in assigning these proportions, if we think he was being numerological? There are several ways of thinking about numerology in this chapter which would suggest that it was not.

Empedocles

Empedocles of Akragas (c. 495–435 BCE) is famed as the first presocratic to give us a four-element theory of earth, water, air and fire and for his conception of a cosmic cycle. His work presents no small difficulty though. The problem is that some fragments seem to give us a naturalist account of the cosmos, its origins and fate along with the origins of life, with some interesting innovations but very much in the *periphrasis* tradition. On the other hand, some fragments talk of the transmigration of the soul, of magic, of purification of the soul, of bringing back from Hades the strength of a man who has died, of Empedocles himself as some form of god among men and as some form of divine prophet.

One solution, emanating from Diels, is to suppose that Empedocles wrote two poems, one *On Nature*, the other *On Purifications* and to allot the ‘scientific’ fragments to the first poem and the ‘religious’ ones to the second. One might then date *On Purifications* as later or earlier than *On Nature*, with Empedocles developing his thought between the two.¹ This is now seen as seriously outdated and relying on a nineteenth-century historiography of an antithesis between science and religion.² Editors have also failed to agree how to distribute the fragments between the supposed two poems.³ This can be used as a strategy for elision as well. Assuming two poems, we privilege the *On Nature* poem. *On Purifications* can then be thought of as an earlier work, with Empedocles progressing from a religious/magical view to a more scientific one, or *On Purifications* can be seen as a later work, with Empedocles declining in old age. In either case we privilege *On Nature* and marginalise or ignore the religious/magical evidence of *On Purifications*.

With the discovery of the Strasbourg papyrus, which gives us some new material on Empedocles, and the breakdown of the ‘conflict’ historiography of science and religion any boundary between the two supposed poems has become further blurred. Inwood now doubts that there were ever two separate poems and indeed the evidence in favour of two poems is remarkably thin,⁴ though Primavera finds new ancient evidence for two poems of differing sizes.⁵

As far as this chapter is concerned, I am not worried whether there were one or two poems. Even if there were two, we have no a priori grounds for treating them in a different manner, as representing different phases of Empedocles’ thought or being

written for two different audiences. We have to deal with the fragments on an even footing and we have no grounds for, e.g. placing all the fragments compatible with a naturalistic interpretation in one poem, all the rest in another and then having some explanation why the rest do not represent the true thought of Empedocles.

Empedocles wrote in hexameter poetry, which does not make the task of interpreting him easier. Even in the ancient world, there was a dispute about the nature of Empedocles' poetry. Plutarch tells us that:

It is not Empedocles' habit to adorn his topic with vacuous descriptions, akin to some bright flowers, to create a beautiful style, but rather he gives a precise illustration of all substances and powers.⁶

Aristotle, on the other hand, is rather more disparaging:

Homer and Empedocles have nothing in common except metre, so while it would be just to call the former a poet, we should rather call the latter a physical philosopher.⁷

One issue in Empedocles will be how much licence we have to see references to gods etc. as poetic representations which can be given a naturalistic interpretation.

Empedocles' ontology

It is possible to make a case for Empedocles being a naturalist. Let us begin with his ontology. To a certain extent, Empedocles agrees with Parmenides in that there can be no generation from nothing. So Empedocles says that:

There is no birth of mortal things, nor do any end in some unhappy death, but there is only mixing and interchange of the mixed, birth being the name given to these things by men.⁸

He also says that:

It is not possible for something to be generated from the non-existent and that something which exists should be destroyed cannot be accomplished and is utterly unheard of.⁹

Pseudo-Plutarch also tells us that:

Empedocles affirms that nature is nothing else but the mixture and separation of the elements.¹⁰

This then looks like standard *periphrasis* tradition material. There are some basic entities which do not come into or go out of existence and what we understand as change is the mixture and separation of these basic entities. Empedocles Fr. 135 is also interesting in that it says:

This law for all extends through wide ruling air and through the boundless light of the sun.¹¹

This is generally taken to refer to the prohibition on eating meat or beans. However, it is expressed in a physical manner and we might take it to be an expression of universal physical law instead.¹²

Empedocles and meteorology

As presocratic meteorology has been a major theme for this book, we ought to look at what Empedocles has to say. Aristotle in his *Meteorologica* informs us that:

Some say that in the clouds there is fire. Empedocles says this is the sun's rays trapped in the clouds ... Lightning is this fire flashing through the clouds, thunder the noise of it being quenched.¹³

So some novelty in that the sun's rays are involved in the explanation of lightning and thunder but we do have a natural explanation and no sense of any of this being caused by the gods. Seneca in his *Natural Questions*, discussing hot springs says that:

Empedocles says that there is fire in many places which the earth covers and which heat the water.¹⁴

Empedocles himself says that:

Iris brings from the sea a wind or great rainstorm.¹⁵

So the rainbow (or the phenomena associated with the term Iris) is associated with bad weather. There is no explanation for the rainbow here but no sense it is a portent sent from the gods either. Given that we have a good number of fragments from Empedocles, lots of testimonia and that Pseudo-Plutarch and Stobaeus reference Empedocles a lot, this is actually not very much on meteorology compared to other presocratic thinkers. However, the explanations are natural with no sense of these being caused by the gods,

Empedocles' cosmogony

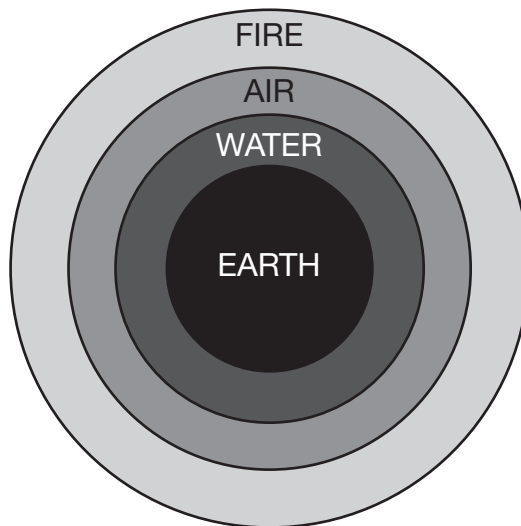
The details of Empedocles' cosmic cycle have been much debated and there have been several different ways to think about how the cycle may work. I am going to offer my own view here but not defend it in any depth or detail. I hold the orthodox or symmetrical view (so called because it sees the roles of love and strife as symmetrical) with a few minor variations.¹⁶ What I want to show here is that it is possible to have a view of Empedocles' cosmic cycle where there are only natural entities and processes.

Empedocles' cosmic cycle can be broken up into four phases, though it ought to be emphasised that Empedocles does not make these divisions. As the process is cyclical, the numbering of the phases, and the point at which one starts is entirely arbitrary. The key processes are that love associates the four Empedoclean elements of earth, water, air and fire into a homogeneous mixture, and then strife dissociates the elements into four separate groups. So the four phases are:

- 1) The complete domination of strife, where the four elements are entirely dissociated and there is no mixing.
- 2) Increase in the influence of love, such that the elements become increasingly mixed with one another.
- 3) The complete domination of love, such that there is a perfect mixing of the elements.
- 4) Increase of the influence of strife, such that the elements become increasingly dissociated from each other.

There is cosmogony and zoogony under the increasing influence of love, working by association of the elements. However there is also a destruction of the cosmos and living things as love nears complete domination. Similarly, there is cosmogony and zoogony under the increasing influence of strife, working by dissociation of the elements. Again there is a destruction of the cosmos and living things as strife nears complete domination. When love is completely dominant there is rest. It is not clear how long this lasts for,¹⁷ but at least long enough for Aristotle to complain about the conceptual difficulties involved in restarting motion in the universe from a state of total rest.¹⁸ When strife is completely dominant there is maximum motion, although it is unclear what that might amount to. This is momentary and love begins to increase its influence directly after the high point of strife.¹⁹ Technically this gives us only three phases as the dominance of strife is only momentary, but it has traditionally been counted as a phase in the orthodox interpretation. This, or something close to it, is shared by those who opt for the orthodox or symmetrical view of Empedocles' cosmic cycle. All that is required here are the four Empedoclean elements and the two principles of Love and Strife. So this can all be understood in an entirely naturalist manner.

My own view of Empedocles' cycle emphasises the role of chance in cosmogony for Empedocles and the differences between successive cycles rather more than other accounts. Some interpretations have the distribution of the elements at total strife like this:



An alternative view is that total strife is more like a 1960s lava lamp, where one might have the four Empedoclean elements represented by four different coloured immiscible liquids. At total strife, each liquid is in one drop and not many, but the drops may have all sorts of shapes and distributions, the above diagram being merely one possibility. If the above diagram happened every time, then the next phase of the cycle might be identical every time. With the lava lamp model, it may be radically different each time.

Total love does give us the same thing each time, but there is a question of how determinate the cosmology is. Aristotle tells us that:

Empedocles says that air is not always separated out upwards²⁰ but according to chance – he says in his cosmogony ‘Thus at one time it ran by chance, but many times it was otherwise’ – and he says that the parts of animals are for the most part generated by chance.²¹

If this evidence is reliable, it is of considerable significance because the separation of air is absolutely fundamental to Empedocles’ cosmogony.²² So I agree with Trepanier who says that:

Empedocles’ cosmic cycle did not consist of a completely identical pattern of recurring events, as in the later Stoic doctrine of the cosmic cycle.²³

The lack of teleology and the strong role for chance in Empedocles’ cosmogony militate against any divine intervention in the cycle. It also allows us to understand why the cycle repeats. With a strong role for chance and different contents for each cycle, there need to be repeats in order that we eventually get a world like ours. Empedocles does diachronically what the atomists do synchronically with multiple cosmoi.

Empedocles’ zoogony

Empedocles is famous, perhaps even notorious for his explanation of the origins of life. There are several stages to Empedocles’ zoogony, beginning with the generation of body parts. We then get their chance association and ultimately the formation of creatures which are viable in themselves and are able to reproduce. At the first stage:

Earth came together by chance with these in roughly equal quantities, Hephaestus, rain and shining air, anchored in the perfect harbours of Kupris, either a little more or in more of them. From these were generated blood and the types of flesh.²⁴

And kindly earth received in its broad melting-pots two parts of the glitter of Nestis out of eight, and four of Hephaestus; and they became white bones, marvelously joined by the gluing of Harmonia.²⁵

Hephaestus in the first passage is generally taken as a poetic expression for fire, so we have the four Empedoclean elements of earth, water, air and fire coming together to form blood and flesh. Kupris is symbolic of love. In the second passage, Hephaestus is again fire while the ‘glitter of Nestis’ is taken to be water and air. Once we take the

poetic names away, we have earth, water, air and fire coming together by chance in certain proportions to make blood, flesh and bone.²⁶ Here one would reasonably suppose that there were many other occasions where these ingredients came together, but not in the right proportions, and so blood, flesh and bones were not formed. Pseudo-Plutarch gives us an overview of the generation of life for Empedocles:

Empedocles believed that the first generation of animals and plants were not generated complete in all parts, but consisted of parts not joined together, the second of parts joined together as in a dream, the third of wholes, while the fourth no longer came from homogenous substances like earth and water, but by mingling with each other.²⁷

So at the next stage we then have the dream (nightmare?) scenario of:

On the earth there burst forth many faces without necks, arms wandered bare bereft of shoulders, and eyes wandered needing foreheads.²⁸

Many sprang up two faced and two breasted, man faced ox progeny, and conversely ox headed man progeny.²⁹

These things fell together, encountering each other by chance, and many other things were constantly being produced.³⁰

So the parts of bodies join up in an accidental fashion and there is no mention of any part being played by any other agency. Aristotle then says:

Whenever everything happened as if it were generated for the sake of something, then they survived, having come together accidentally in a suitable manner. Where this did not occur, however, they perished and are still perishing, as Empedocles says concerning his 'Man faced ox progeny'.³¹

Ultimately the result of this process are species which are capable of having viable offspring. The process in itself can be seen as an entirely natural one. The elements come together by chance to form body parts, they come together by chance to form viable species.

Love and Strife

Sometimes Love and Strife are referred to as forces.³² I have very strong reservations about this and would much prefer to call them principles of association and disassociation. Love and Strife are entities on their own rather than properties of matter. They do not generate attractive or repulsive forces between matter, they just effect association or dissociation. Contrary to what we understand as forces, their effect varies over time. Their effect also discriminates between different types of matter.³³ It is better to refer to love and strife as principles of association and dissociation respectively. This is not to single out Empedocles, as I have reservations about using the word force in this sense in relation to any of the presocratics. As we will see with

Leucippus and Democritus, I also object to calling the like to like effect a force. It is not, it is a sorting principle which operates only when the correct type of motion (vortex motion) is happening.

I take the view that there is no teleology in Empedocles. I have argued this in some detail elsewhere, so will just note the main points here.³⁴ One might question whether there is an end state for Empedocles at all, given the cyclical nature of his cosmology. If there is to be an end state, it is difficult to see just one on the symmetric model. Total association and total dissociation are the effects of Love and Strife so would be the main candidates but that gives two end states. A cosmos is both generated and destroyed by both Love and Strife so could hardly be an end state but that looks odd in relation to Greek teleology generally. Teleology is generally associated with intelligence and the good but that looks odd when Love and Strife destroy the cosmoi they create.³⁵ Some passages appear to indicate teleology in relation to the generation of the eye,³⁶ but one can commonly find even modern biologists and biology texts employing explanations which look as if they imply intelligent design when no such implication is intended. One might quite easily say, when explaining the function of the eye, that 'the eye is designed such that ...' while remaining a staunch evolutionist.

If that is so, cosmology for Empedocles is the action of the two principles of Love and Strife on the Empedoclean elements and that looks to be entirely natural for both entities and processes. I recognise that there are many other viable views of Empedocles but these are not problematic for the naturalist view. If there is teleology for instance, that is unlikely to be problematic given what we have seen with the Milesians. There are other views about the succession of phases in the cycle but again these do not make any part of the cycle non-natural. There are though significant similarities between how Love and Strife work and the idea of sympathetic interaction. As Kingsley has pointed out:

These forces of love or attraction and strife or repulsion are the fundamental governing principles of magical operations both in the ancient Greek world and elsewhere.³⁷

Sympathies may be part of the magical view, but that does not make them of necessity anything non-natural. To quote Plotinus again:

How is there magic? By sympathy, and that naturally there is a sympathy between like things and an antipathy between unlike things.³⁸

Aristotle certainly saw Love and Strife as natural agents:

Strife is no more the reason for destruction than it is for being. Similarly, nor is love in relation to being. For drawing everything into one it destroys everything else. At the same time he gives no account of the reason for change, except that it is natural – 'When great strife had grown strong in the limbs, and sprang to its realm as the time came, which was appointed for them in turn by a broad oath' – as if change were necessary. But he gives no reason for this necessity.³⁹

One can then build a strong case for Empedocles employing only natural explanations if we restrict ourselves to a certain set of fragments.

Empedocles' gods

Empedocles does talk about gods in the context of the cosmic cycle, these gods seeming to be long lasting rather than immortal. As Trepanier has pointed out, long life rather than immortality is adequate for a god in Empedocles. If there are no immortal entities, this lessens the tension between the theology and the physics.⁴⁰ Material from the Strasbourg papyrus tells us that:

But in Love we come together to form a single ordered whole.
Whereas in Hatred, in turn, it grew apart, so as to be many out of one,
From which come all beings that were, all that are, and all that will be hereafter:
Trees sprang up, and men and women,
And beasts, and birds, and fish nurtured in water, and even long-lived gods,
unrivalled in their prerogatives.⁴¹

We get something similar in Simplicius:

In anger they have different forms and are all apart,
But in Love they come together and are desired by one another,
For from these come all beings that were, all that are, and all that will be
hereafter:
Trees sprang up, and men and women,
And beasts, and birds, and fish nurtured in water, and even long-lived gods,
unrivalled in their prerogatives.⁴²

One strategy here is to look for ways in which something which Empedocles would recognise as a god could come about through the physical processes described here, such that we have natural, long-lived but not immortal gods.⁴³ Primaversi has argued that the sphere which results when Love is completely ascendant is referred to as a god by Empedocles.⁴⁴ Primaversi has also argued that, at the other end of the cosmic cycle, while the elements are immortal, the four pure groups they form when Strife is completely ascendant are long-lived but mortal and can be considered in some sense as gods.⁴⁵ Empedocles' mythology mirrors the cosmic cycle and can be explained in terms of it,⁴⁶ in a similar way to that in which Homer's gods were taken to represent physical entities.⁴⁷ So in Fr. 115, when a god is expelled from the companionship of the other gods for trusting in Strife, this mirrors the break up of the Sphere by Strife as the complete domination of Love ends.

With the mirroring analogy, it is notable that the view pursued is that the theology mirrors the physics and that we can explain the theology in terms of the physics, so gods are really elements, etc. However, the mirroring analogy could be taken in reverse, such that the physics mirrors the theology and the elements are really gods. Again, this mirroring can be thought of in terms of privilege and elision. If the theology mirrors the physics, the physics is primary and to some extent we have managed to marginalise or downplay the theological aspects of Empedocles' thought. Reverse that, and say the physics mirrors the theology and we might have a radically different picture of Empedocles. This is not to advocate such a view, merely to raise

its possibility and to question why we privilege the first model over the second. One might try to do that in terms of similarity to ancient interpretations of Homer, or perhaps out of historical generosity to Empedocles. So we try the mythology mirrors the physics line first. If that cannot be made to work, though, the second line might be worth thinking about.

Empedocles' magic?

There are some difficulties for a naturalistic reading of *On Nature* in that the final fragment, Empedocles Fr. 111, says that:

All the remedies (*pharmaka*) which exist as a defence against evils and old age
 You will learn, as for you alone will I accomplish all these things
 You will stop the might of tireless winds which over the earth
 Sweep and destroy fields with their gusts
 Then again, if you wish, you will bring on the requiting winds
 You will make, from a black rainstorm seasonal drought
 for men, and out of a summer drought you will generate
 Tree nourishing streams that dwell in the aether
 and you will bring back from Hades the strength of a man who has died.⁴⁸

In the first line we have *pharmaka*. *pharmaka* is best rendered 'remedies' rather than potions as it leaves open the possibility that different types of therapy are involved here, as LSJ give as a possibility for *pharmakon* 'enchanted potion, philtre: hence, charm, spell'.⁴⁹ Weather working was seen as part of magic, and was sometimes attacked as such, as we saw with *On the Sacred Disease* and the comments on 'If a human by magic and sacrifice can bring down the moon, eclipse the sun, make storm and good weather.'⁵⁰ The final line appears to assert the existence of Hades and the possibility of necromancy. On why this knowledge is 'for you alone', Kingsley argues that the relationship of mage and apprentice has traditionally been a secretive one with the knowledge of magic privileged between them.⁵¹

There are a number of strategies one might try to argue that this passage is naturalistic. Diels' view is that this passage promises nothing more than modern science does, the content of the laws of nature such that nature can be controlled.⁵² Even if we take *pharmaka* simply as medical remedies, this looks rather strange though. It is difficult to see how science will give a single person the ability to control the winds or to create rainstorm and drought. There are also considerable magical resonances here.

One might then try to think of this in terms of a natural magic.⁵³ Betegh, talking about a passage in the Derveni papyrus, comments that:

The obvious parallel here is Empedocles, and especially his promise at B111 to impart knowledge of controlling nature in an extraordinary, but not supernatural way.⁵⁴

On this approach, we treat *pharmaka* simply as medical remedies or natural magic remedies. We take the view that 'to you alone' is poetic emphasis, as it would be odd

to advertise privileged knowledge in a poem. The weather working we take as natural magic based on an enhanced knowledge of the elements and Love and Strife. The difficulty though is the final sentence. Bringing back the strength of a dead man from Hades can hardly be construed as natural magic. Whether that is done by a spell or invocation from here or whether it involves some form of spiritual or physical travel to Hades,⁵⁵ I do not see how this can be done naturally, if we take the last line literally. If the final line was a single line fragment on its own, one might attempt to read it as something to do with metempsychosis, the cycle of reincarnations being hell. The context of the claims leading up to the final line are very much against such a reading though. One might try a reading along the lines that we are already in hell in our ordinary lives, and the fragment is about education and being lifted out of that hell. The fragment offers to do that for you and you in turn will be able to do that for other people.

Alternatively, one might read the final line as an allusion to resuscitation or aiding recovery from some near-death experience where someone's life force might be thought, poetically, to have departed for Hades. So there need be no commitment to Hades existing or our travelling there or summoning souls in the manner of Odysseus in *Odyssey* XI. In favour of that view one might argue that this fragment begins with something medical and now ends with something medical and that matches the cyclical patterns and themes that can be found elsewhere in Empedocles' poetry. Also in favour of this reading is that Empedocles is supposed to have written extensively on medicine, although those works are now lost.⁵⁶ What one might also argue in terms of setting is that Empedocles gives us a strongly natural account of cosmogony, zoogony and the cosmological cycle in general. That then gives us a licence to interpret this passage in natural terms if it is possible to do so. Curd comments that:

In B111 Empedocles holds forth the promise of remarkable and seemingly supernatural skills, yet embeds this promise in the naturalistic account of the roots of all things, of the forces that combine and separate these roots and the consequent formation of the *kosmos* and living things.⁵⁷

There are some other less effective strategies here. We could move this fragment from *On Nature* to *On Purifications* and employ some strategy to lessen its effect. It is difficult though to see how 'and you will bring back from Hades the strength of a man who has died' fits as a mirror to any part of the cosmic cycle. There is also an issue of justification and pre-judging the sort of Empedocles we want. Wright has Fr. 111 as the last fragment of *On Nature*,⁵⁸ Inwood has Fr. 111 as his fifteenth passage so there is no consensus to move the passage away.⁵⁹ Kingsley argues that Fr. 111 should be close to the beginning.⁶⁰ The attempt by van Groningen to excise the passage on the grounds that there is nothing comparable elsewhere in Empedocles is unconvincing.⁶¹

I will reiterate a point I made in the chapter on Plato and Aristotle. It is perfectly possible to be interested in philosophy and magic or natural science and magic. It is perfectly possible to theorise and philosophise about the nature of magic. The basis for magical disciplines is there in Aristotle and Plato and there are many examples of how that was developed in later antiquity and in the Renaissance. Just as the historiography of permanent antithesis between science and religion has broken down and had

consequences for Empedocles scholarship, so has the historiography of permanent antithesis between science and magic. A further issue here is whether Empedocles was a philosopher with an interest in magic or whether magic formed a fundamental part of his thinking.⁶² It should be clear that with Renaissance thinkers such as Kepler and Harvey,⁶³ aspects of magic were fundamental to their thinking and indeed to the revolutionary theories they put forward in astronomy and anatomy. We cannot immediately dismiss the idea that Empedocles had magic as a fundamental part of his thinking.

Empedocles as a shaman?

Dodds claims that:

Empedocles represents not a new but a very old type of personality, the shaman who combines the still undifferentiated functions of magician and naturalist, poet and philosopher, preacher, healer and public counsellor.⁶⁴

The last line of Fr. 111, 'you will bring back from Hades the strength of a man who has died' has led some commentators to compare Empedocles to a shaman.⁶⁵ However, I would disagree with Kingsley who comments that:

There can be no possible justification for avoiding the literal meaning of this remarkable statement or trying to interpret it away allegorically.⁶⁶

It is one possibility to take this line literally, but given that Empedocles wrote in poetry and other parts of his poem are clearly allegorical, we can at least consider other ways to interpret this line as I have above. Certainly, communing with the spirits of the dead is one thing that shamans are supposed to do. However, one similarity does not make an identity and there are differences between what we know about shamens and what we know about Empedocles. One might add though the usual conception of a shaman includes the ideas of divination and healing and we get these in Fr. 112. There is no sense here though that Empedocles believed in the need to enter into some state of altered consciousness in order to commune with the dead, if that indeed is what is meant by this line. As with Pythagoras, it is one thing to say that they share some of the traits of a shaman, another thing to say that someone was a shaman.

Empedocles' claims

Empedocles Fr. 112 may also make some claims which are problematic for a naturalistic reading. Guthrie comments that in fragment 112:

The same arrogance and claims to supernatural powers appear in his promise to Pausanias in his poem on nature (fr. 111).⁶⁷

Indeed it is hard to construe Fr. 112 in an entirely naturalist manner:

O Friends, who live in the great city of the yellow Acragas,
 in the highest part of the city, caring for good deeds,
 I greet you. I am a divine god to you (*humin*), no longer mortal
 I go around honoured by all, as is fitting
 crowned with ribbons and festive garlands
 I am revered by all I come upon as I arrive at flourishing towns,
 men and women. They follow me
 in countless numbers, asking for a short cut (*atarpos*)⁶⁸ to profit (*kerdos*),
 some eager for divination (*mantosuneôn*), some for diseases
 of all kinds seeking to hear an oracle (*baxin*) of healing,
 for too long having been pierced by pain.⁶⁹

Empedocles claims to be a god and no longer mortal. His actual claim is *theos ambrotos, ouketi thnêtos*. Now *ambrotos* can mean 'immortal, divine, of persons as well as things' (LSJ). What I have translated here as 'profit' (*kerdos*) can also have a sense of 'cunning arts, wiles' (LSJ),⁷⁰ which may fit well if we are going to take divination and healing oracles in a magical sense.⁷¹ If the learning process for magic was supposed to be long, one can then see why the masses would ask for a short cut to knowledge of 'cunning arts, wiles', though even if we take *atarpos* in the sense of route the crowd may still be asking for magical knowledge rather than simply material gain. Empedocles also at least appears to make the claim that he is able to engage in divination and is able to give oracles of healing.

Again, one can attempt a naturalistic and deflationary reading of this passage. On this reading it is the crowd, the credulous masses, who are eager for divination and a healing oracle and nothing is said on whether Empedocles can supply these or not. Alternatively, one can take divination here in the sense of prognosis, perhaps in the way that the Hippocratics took prognosis to be properly grounded foresight and the proposed healing to be natural, or perhaps magical in some sense and natural.⁷² The crowd would like a route or a short cut to profit simply considered financially with no magical sense here.

The real problem is Empedocles' claim to be a god and no longer mortal. One might argue that Empedocles does not claim that he is an immortal god, but that he is an 'immortal god to you (*humin*)', a very different proposition. You, the credulous masses, may be wrong, especially given Empedocles' view of the masses.⁷³ That he is honoured 'as is fitting' need not imply he actually is a god, but that it is fitting that he be honoured if the masses think he is a god.

Against this deflationary view, Empedocles does claim to be a god in several other passages and claims to be superior to mortal men.⁷⁴ Presumably he does not die and is in some sense a god. We can also look to Empedocles 146:

In the end they are prophets (*manteis*) and minstrels and doctors and foremost men among those who dwell on earth, they then rise up as gods of highest honour.⁷⁵

The standard view of fragment 146 is that Empedocles lays claim to all four of the activities mentioned here and so sees himself as someone who has risen to be a god. That he mentions prophecy here is not problematic if again we take the Hippocratic

line on prophecy, though here one might worry that he means prophecy rather more broadly than medical prognosis. The question then is whether Empedocles' physics can accommodate gods and the process of becoming a god.

Metempsychosis

Empedocles seems to have believed in metempsychosis, the transmigration of the soul from one body to another after death. This is most simply stated in Empedocles Fr. 117:

Prior to now at some stage I have been boy and girl, bush, bird and a mute fish of the sea.⁷⁶

That needs to be put in a broader context though and it is notable that Empedocles says that he has been many things before but does not assert universal metempsychosis. In relation to this one might read Empedocles Fr. 113 in a different light:

I am superior to mortal men who die many times (*poluphthereôn*).⁷⁷

poluphthereôn here is ambiguous between dies many times or can be destroyed in many ways. So one might read this as Empedocles being immortal and being superior to men who have a cycle of reincarnations, or as Empedocles being subject to reincarnation while men die once, being destroyed once and for all in many different ways. Fr. 115 sets a background to metempsychosis with the breaking of an oath followed by exile for 30,000 years and undergoing a cycle of reincarnations of mortal forms.⁷⁸ Empedocles admits:

I too am one of these, a fugitive from the gods and a wanderer, having placed my trust in raving Strife.⁷⁹

Again, there is an ambiguity here though. Empedocles may be the only one, or one of a few to break the oath and so his reincarnation cycle is an exception among humans. Alternatively, if we are reading this allegorically and what is happening at one level is the breaking of the sphere by strife and all the elements are then exiled, then metempsychosis may apply to all human beings. There is also an issue of immortality for Empedocles. Gods who are 'long-lived' might be accommodated in the physics, their lifespan ending with the total dominance of Love or Strife. Genuinely immortal gods though would be more problematic. In Fr. 112, we noted that Empedocles' claim was *theos ambrotos, ouketi thnêtos*. So while he is no longer mortal, if we take *ambrotos* as divine, he does not claim the stronger form of immortality either. However, Fr. 147 comments on:

Sharing hearth and table with other immortals (*athanatois*), being free of the woes of men and untiring.⁸⁰

That looks more problematic unless we take it that in all places immortal simply means long-lived for Empedocles with no contrast between the two.

Related to the belief in metempsychosis was a prohibition on eating meat. So Empedocles asks in Fr. 136:

Will you not end this noise of slaughter? Do you not realise you are eating each other on account of your careless thinking?⁸¹

Empedocles includes himself in this:

Woe that the pitiless day did not first destroy me, before for my lips I devised the cruel deed of flesh eating.⁸²

Clearly there are similarities with the Pythagoreans here, and Empedocles is also adamant that one should not eat beans:

Wretches, utter wretches, keep your hands off of beans!⁸³

The breadth of these prohibitions, especially Fr. 136 would suggest that all humans are subject to metempsychosis and so if Empedocles thinks himself above humans, he may well think himself to be immortal. Much of the analysis of Pythagorean metempsychosis is going to apply to Empedocles as well. We have very little definite information on the nature of Empedoclean metempsychosis. We have little on Empedocles' account of the soul and we do not know if the entire soul or only part of it was supposed to transmigrate. We have nothing at all on the nature of the actual transmigration, of how the soul moved from its previous host body to the next host body. We do know some more with Empedocles on what sort of living things could host a soul, including a bush, a bird and a fish. Whether the soul was immortal for Empedocles is also a difficult issue. If the soul is some natural entity, or is emergent from natural entities the soul will be destroyed in the cosmic cycle when Love and Strife come into their respective completely dominant phases. However we do not know the nature of the soul for Empedocles and as we have seen, he seems to think that he can make the jump from being a mortal to being a god. Whether that is possible for everyone and whether, if it is possible it happens to everyone are questions we do not have enough information to decide. This uncertainty makes it very difficult to say whether anything non-natural was involved in metempsychosis.

This section brings out one of the major issues in Empedocles scholarship. If there is an ontology of the four elements, Love and Strife, then anything composite will be destroyed in the cosmic cycle. Gods are acceptable within this ontology, natural even if they are generated naturally by the elements, Love and Strife as long as they are long-lived but not immortal. There are though passages, as we have seen, where Empedocles seems to posit immortal gods. If such gods do exist then *a fortiori* they are going to be outside nature. The attraction of having a unified account of Empedocles' thought, with the unification taking place around the natural philosophy of the cosmic cycle and the four elements, Love and Strife ontology is very strong.

Empedocles and Homer

In many of the presocratic thinkers we have looked at, we find some targeting of Homer and/or Hesiod on the issue of natural explanations, or the targeting of interesting, important or difficult-to-explain phenomena. Although we have a couple of comments on meteorology in Empedocles,⁸⁴ I do not think we see the targeting of Homer and Hesiod, or of interesting, important or difficult to explain phenomena in the same way. I want to suggest that Empedocles does target Homer, but to emphasise what he believes humans can do rather than to assert natural explanations. Empedocles certainly targets other of his predecessors. It has often been recognised that Empedocles alludes to passages in Parmenides. So Parmenides says that:

With this I finish my reliable account and thought concerning truth. Learn now the beliefs of mortals, listening to the order of my words.⁸⁵

Empedocles seems to be speaking directly to this when he says:

Listen to the undecitful passage of my words.⁸⁶

It is arguable that Empedocles also targets Heraclitus.⁸⁷ So Fr. 3, 'Not holding sight to be more trustworthy than hearing' may be a comment on Heraclitus Fr. 101, 'Eyes are more accurate witnesses than ears.'⁸⁸

Empedocles fragment 111 is very important in the context of a critique of Homer. As we have seen, winds and rains in Homer and Hesiod are under the control of the gods. In many of the presocratic thinkers we have looked at, they are seen as entirely natural phenomena. In Empedocles though, there is a claim that humans can have control of the weather. There is also an important point in this line of Fr. 111:

Then again, if you wish (*ethelêistha*), you will bring on the requiting winds

As Kingsley has pointed out, this phrase is used frequently in Homer and Hesiod in relation to the divine powers of the gods.⁸⁹ Empedocles then seems to be saying that these powers are not the prerogative of the gods and that humans can exercise them as well. In most of the thinkers we have looked at, there is no realm where the dead have some form of afterlife. Empedocles though seems to believe that Hades exists, and moreover that he can in some way journey there and bring back the strength of a man who has died. That a mortal can do that certainly breaks with Homeric ideas.

Fragment 112 is also important, depending on quite what we consider that Empedocles claims here. If he claims to be an immortal god and we take that as a progression from fragment 146 where 'prophets and minstrels and doctors and foremost men' become gods, then certainly that breaks with the Homeric distinction between immortal gods and mortal men. Empedocles may also make a claim to divination and oracular healing and to be able to teach 'cunning arts, wiles'. If so he is claiming considerable magical powers for himself. That in turn might lead us to reconsider *pharmaka* in fragment 111 line 1 as claiming some magical medical power rather than simply employing the potions of natural medicine.

The metempsychosis fragments are also significant in this context just as they were for the Pythagoreans. After death there is no longer simply the worthless shadow life,⁹⁰ but there is the promise of reincarnation.

Empedocles then does not seem to want to emphasise natural explanation in contrast to the views of Homer and Hesiod. Rather, he seems to want to emphasise human power and ability against Homer and Hesiod. So humans can control the weather and bring back from Hades the strength of a man who has died. Humans can become gods and gods can be caught in a cycle of reincarnation. Humans can achieve divination and magical healing. It is possible to argue that Empedocles only argues for what humans are able to do naturally (so e.g. the Hades passage is about medical treatment of near death, rather than necromancy), but if that is so it seems secondary to his emphasis that humans can do what is usually attributed to the gods.

Pythagoras, Empedocles and the canon

In the past few chapters we have looked at Pythagoras, the early Pythagoreans and Empedocles. These are the best candidates from within the standard canon of presocratic philosophers for people who did not entirely reject the non-natural in favour of the natural. If we take the view, for example, that Pythagoras and/or Empedocles did not fully reject the non-natural, is that damaging to what I want to argue in this book? There are two related replies to this. First, primarily this book is an investigation into what natural and non-natural meant for the presocratics and how the views of various presocratic thinkers relate to that distinction. As I said in the introduction, it is not the agenda of this book either to cleanse or to implicate the presocratics or some group of presocratics in relation to belief in the non-natural. Second, part of the outcome of this investigation is that I do indeed want to argue that there is a group of presocratics who rejected the non-natural in favour of the natural. However, this group is not co-extensive with the standard canon of presocratic philosophers. It includes some more people than that canon – many, perhaps all of the Hippocratic writers, possibly some more medical writers like Alkmaeon, the commentator on the Derveni Papyrus and maybe more in their tradition, Thucydides, possibly some playwrights and elements of their audiences. It is quite possible that, without detriment, it includes a few less people than that canon as well, such as Pythagoras and Empedocles.⁹¹ Indeed, in one way that would strengthen one thesis of this book, that we need to look carefully on a case by case basis at what each presocratic thought, rather than make broader assumptions on supposed group affiliations.⁹² That, as we have seen, applies not only to a broad group such as the canon of presocratic philosophers, but sub-groups such as the Hippocratics and the early Pythagoreans as well.

Conclusion

It is possible to make a case that Empedocles used entirely natural explanations, based on his ontology of the four elements along with Love and Strife. It is quite possible

to construe the actions of Love and Strife as entirely natural, even if we believe them to act in a sympathetic manner. We can take a deflationary view of Fr. 111 and Fr. 112 such that nothing non-natural, at least from Empedocles' point of view, is being asserted. That there is such a strong natural account of cosmogony, zoogony and the cosmic cycle indicates that this is a strategy we should at least consider. It is also possible to understand Empedocles' references to 'long-lived gods' on this account, as part of the cosmic cycle who live many times the lifespan of humans but perish when Love or Strife become completely ascendant.

However, there are passages where Empedocles appears to posit immortal beings and even passages where he claims to be a god himself. As nothing natural can be immortal for Empedocles, that seems to put these entities outside of nature. Fragments 111 and 112 can be read as claims to divination, magical healing, being able to control the weather and being able to bring the strength of a dead man back from Hades. There is also the consideration that if Empedocles claims to be a god and claims to be able to control the weather, in contrast to the tradition we have traced from Anaximander on, Empedocles has the gods controlling the weather.

Empedocles seems to have had a different agenda in relation to Homer and Hesiod to many of the thinkers we have looked at so far. Where many presocratic thinkers targeted Homer and Hesiod and gave natural explanations for important phenomena, Empedocles appears keener to emphasise the abilities of humans relative to the accounts of Homer and Hesiod. Those abilities seem self-consciously magical and it is very hard to see them all as natural magic.

How far did Empedocles' influence spread among those who did not take him to be a natural philosopher? There is the tale that Empedocles died by leaping into the volcano at Etna, with variations of the tale having him wearing a bronze sandal which the volcano spits out again.⁹³ Whether he did so or not (and personally I am sceptical) the important thing is the symbolism of the tale for his followers. The leap into the volcano can be taken as symbolic of ritual purification and a voluntary descent into the underworld. A single bronze sandal was the symbol of a magician.⁹⁴ Those who generated or embellished this tale clearly took this side of Empedocles seriously. That is an important counterpoint to the way that the philosophical tradition, following Aristotle, took him to be a natural philosopher. As with the early Pythagoreans, we have no way of knowing how widespread this view of Empedocles was.

My conclusion here is somewhat cautious as Empedoclean scholarship is in a state of flux. Recent work has made interesting attempts to understand the status of the long-lived gods as part of the natural physics of the cosmic cycle.⁹⁵ It may be that we can understand the claims of Fr. 111 and Fr. 112 in a natural manner, especially given the extensive natural explanations of cosmogony, zoogony and the cosmic cycle in general. Despite (what appear to us to be) the idiosyncrasies of Empedocles' system, he may have considered it himself to have been entirely natural. If we cannot deflate or explain the claims of Fr. 111 and Fr. 112 though Empedocles does make claim to non-natural abilities. One concern here is his agenda in relation to Homer, which does not seem to want to emphasise natural against non-natural explanation, but that humans can do what had previously been attributed to the gods.

Leucippus and Democritus

Leucippus (fl. 440 BCE) and Democritus (fl. 420 BCE) introduced atomism with its ontology of atoms and the void and its rejection of any design or steering factors for cosmogony. Instead, there were an infinite number of different cosmoi in an infinite void, the cosmoi all coming together accidentally rather than by any design or purpose. I hope by now no one is expecting a final triumphant chapter, extolling mechanistic atomism and praising the virtues of a supposed Greek enlightenment. There is a strong positive case that Leucippus and Democritus rejected non-natural explanation in favour of purely natural explanation, and posited only natural entities, though as we will see in the ensuing sections, the case is perhaps not quite so straightforward as one might initially think. Their explanations are not so thoroughly mechanistic as is sometimes assumed and they make surprisingly frequent use of biological analogues. Leucippus and Democritus make use of the notion of like to like. This is often thought of as a force, but this is almost certainly not the case and Leucippus and Democritus did not make use of forces at the atomic level. Neither though is it a sympathy. Finally, Leucippus and Democritus did have a theology and a theory of dreams. Ultimately this is based on their atomist ontology, but these theories do require some investigation. As is common practice, I make no attempt to separate the views of Leucippus and Democritus.

Belief in gods

Leucippus and Democritus attempted to explain how a belief in the gods came about. Possibly the most famous passage in this context is given to us by Sextus Empiricus:

There are those who believe that we come to the idea of gods from remarkable things which happen in the cosmos. Democritus said that in relation to meteorological phenomena, the men of old, in relation to thunder, lightning and thunderbolts, the conjunction of the stars and the eclipses of the sun and moon, were afraid and believed there to be gods because of these things.¹

As we saw in the chapter on the Milesians this is significant in several ways. It targets meteorological phenomena that in Homer and Hesiod are explained by the actions

of the gods. In a moment we will see Democritus' natural explanations for those phenomena. It also explicitly links the origins of a belief in the gods to fear of these phenomena. A less-well-known passage, which is still of considerable importance, is Democritus Fr. 14:

A small number of wise men, raising their hands to what the Greeks now call the air, said 'Zeus thinks of all things, knows all things, gives and takes away and is king of all things'.²

One way of reading this fragment, particularly in relation to the Sextus Empiricus passage above is that while we used to employ explanations relating to the gods for some phenomena (meteorological phenomena as the wise men used to raise their hands to what we now call air?), we have no need of such explanations now as we simply cite air and other natural entities in our explanations of such phenomena. One can read this passage in another way, as affirming faith in the gods (the small number of wise men were right and we are now wrong to explain in terms of air). However, such a reading would not cohere well with the rest of Democritus' views, in particular the Sextus passage above. One can suggest targets for an association of gods/divinity and air. Anaximenes and Diogenes of Apollonia are both possibilities, as we have seen they both associate divinity and air. So too the Derveni Papyrus may be a target, especially as it says:

Existing things have each been called a single name on account of what dominates them, all things being called Zeus for this reason. Air dominates all as far as it wants to. When they say that Moira span they say that the understanding of Zeus sanctions how the things that are, that have been generated and the things that will be must come to be and cease.³

Euripides is also a possible target, Fr. 941 says:

Do you see the high, unlimited aether
Embracing the earth with fluid arms?
Believe it is Zeus, believe it is god.⁴

I actually think Democritus Fr. 14 is rather more general here and is an attack on the idea of the gods controlling meteorological phenomena in general rather than the specific notion of an association between air/aether and god, but the latter is possible as well.

Leucippus and Democritus on meteorology

Stobaeus includes a section on Leucippus and on Democritus under his heading 'concerning thunder, lightning, thunderbolts, hurricanes and typhoons':

Leucippus has thunder come about by a breaking out of fire from the densest clouds. Democritus says that thunder is due to an irregular combination forcing its way down through a cloud which contains it. Lightning is the collision of

clouds, from which the begetters of fire come, and rubbing against itself through the void and porous parts it is strained and gathered together. Thunderbolts occur when the purer, smaller, more even and close packable, as he has written, generators of fire are moved rapidly and forcibly. Hurricanes occur when a combination of fire and much void, held back in a place of much void and enclosed in its own membrane, become an organised body due to their mixture and move violently to the depths.⁵

So Democritus gives entirely natural explanations for thunder, lightning, thunderbolts and hurricanes. Democritus also has something to say about some other significant meteorological phenomena which had been taken to have non-natural explanations. Seneca *Natural Questions* V/2 gives Democritus' account of wind. He reports Democritus as saying that in an empty square or street people can pass unhindered, but when there are many people they bump into each other and become entangled with one another and flow together. Similarly with atoms, where the flowing together constitutes wind.⁶ Aristotle gives us Democritus' account of the nature of earthquakes:

Democritus says that the earth is full of water, and when it receives much more rain water, it is moved by that. For when too much occurs so that the cavities cannot receive it, the forcing out causes the earthquake and when drying out happens there is a drawing to the emptier places from the fuller and the earthquake is the impact of the motion.⁷

Pseudo-Plutarch, under his heading 'On the rising of the Nile' tells us that:

Democritus says when snow in the north melts around the summer solstice, clouds are formed from the vapour. When they are forced south to Egypt by the annual winds they give forth furious rain storms which fully fill the lakes and the river Nile.⁸

So Democritus has an entirely natural account of the flooding of the Nile. Outbreaks of plague were often put down to the intervention of the gods in ancient Greece and there is a famous passage in the first book of Homer's *Iliad* where Agamemnon has angered the gods and they have sent a plague upon his army. Achilles in his speech suggests consulting a diviner or someone good at dreams and wonders whether burning mutton or goat will lift the plague. In relation to this, it is interesting that Plutarch tells us that:

We know that Democritus said and wrote that when worlds outside our own are destroyed foreign bodies flow into here, often they are the source of plague or other unusual happenings.⁹

One might argue that this is hand waving, that there is little that could be done to confirm or deny such a theory and it is alarmingly broad in that any unusual happening might be put down to an influx of atoms from a destroyed cosmos. On the other hand, it does provide an entirely natural account of what had been taken to be a non-natural phenomenon and one that has a prominent place in Homer. On the issue of the origin of humans, Lactantius tells us that:

Democritus was not correct in thinking that humans were generated from earth like worms, lacking any design or creator.¹⁰

Again, although we lack details here we have a natural explanation of what had been taken by Homer and Hesiod to be a non-natural phenomenon.

Metrodorus

Metrodorus (fl. fourth century BCE) was a follower of Leucippus and Democritus, at least on the atoms and void ontology and belief in multiple cosmoi. He too had something to say on meteorology. Pseudo-Plutarch says that:

Metrodorus said that when the wind falls upon a cloud and firmly compacts it, the breaking results in a bang, the striking and cleaving in a flash, the rapidity of motion, the sun imparting heat, in throwing a thunderbolt. The weakening of the thunderbolt produces a hurricane (*prêstêr*).¹¹

Here we have a good selection of the Anaximander phenomena, explained in a fairly standard manner. We have thunder, lightning, the thunderbolt and the hurricane all given natural explanations. It is notable that even someone who held a strongly sceptical epistemology like Metrodorus felt it necessary to give natural explanations of meteorological phenomena.¹²

Atomist ontology

There is a more general philosophical point in relation to the early atomists, which is that their ontology is in one sense highly parsimonious and their thought is generally reductive. It is parsimonious in the sense that there is only what is, the atoms, and the void and no other sort of substance. It is also strongly reductive in that what we perceive can be reduced down to our interactions with atoms. Perhaps the most famous early atomist saying is Democritus Fr. 9:

By convention sweet, by convention bitter, by convention hot, by convention cold,
by convention cold, but in reality atoms and the void.¹³

It is also important the Democritus takes a reductive line on mind/soul, believing it to be constituted from spherical atoms.¹⁴ If there is such an ontology of atoms and the void (and we might reasonably add in motion here as well), and the atoms are simply pieces of being while the void is not-being, it is hard to see how there will be much of a basis for a belief in the non-natural. Importantly, there is no sense of an extended world in Democritus. Democritus Fr. 297 says:

Some people, being ignorant of the breaking up of mortal nature, but aware of
doing evil in their lives, make false stories about a time after the end.¹⁵

Pseudo-Plutarch also tells us that:

Democritus and Epicurus say the soul is mortal and dies with the body.¹⁶

The early atomists employed a like-to-like principle whereby like things were sorted together with other like things in the vortices which produced cosmoi. We will look at the like-to-like principle in more detail later, as there is a debate about whether it is simply an effect of the motions of atoms or whether the atoms have the property of moving like to like. For now I want to make another point about targeting. Pseudo-Plutarch tells us that:

Democritus says that air is broken into similarly shaped bodies and these are rolled in with pieces of the voice. For jackdaws sit with jackdaws and:

‘God always leads like with like’

On the seashore we see pebbles like to each other in the same place, the round ones and the long ones. So too with sieves, where things of like form are brought together, but beans and chick-peas are separated.¹⁷

There is a longer and more detailed passage in Sextus which affirms this sort of thinking about a like-to-like principle and it is clear that the like-to-like principle has a critical role in cosmos formation for Democritus. Plutarch’s quotation here that ‘god always leads like to like’ is from Homer and from a memorable passage in Homer where Odysseus is a beggar and is walking with a swineherd and is insulted on the grounds that ‘god always leads like to like’.¹⁸ Democritus has a natural explanation of the like-to-like principle. He takes the separation of things like-to-like as a natural consequence of the vortices of atoms that form in the void, from which the cosmoi are generated. Again we have an important, memorable passage in Greek literature where a phenomenon which depends on the actions of the gods is being explained in perfectly natural terms and I would argue that Homer is again being targeted by Democritus.

Biological analogues

Leucippus and Democritus are often seen as forerunners of the mechanical philosophy of the seventeenth century.¹⁹ Leucippus and Democritus, while they can quite reasonably be called materialists, can hardly be called mechanists, at least not in the seventeenth century sense of the term.²⁰ Certainly they do not have clockwork as a central explanatory metaphor as many in the seventeenth century did. Fontenelle put it like this:

‘I perceive’, said the Countess, ‘Philosophy is now become very Mechanical.’ ‘So Mechanical’, said I, ‘that I fear we shall quickly be ashamed of it; they will have the World to be in great, what a watch is in little; which is very regular and depends only upon the just disposing of the several parts of the movement. But pray tell me, Madam, had you not formerly a more sublime idea of the Universe?’²¹

Or there is John Locke’s famous passage:

If we knew the mechanical affections of the particles of rhubarb, hemlock, opium, as a watchmaker does those of a watch, we should be able to tell beforehand that rhubarb will purge, hemlock kill, and opium make a man sleep, as well as a watchmaker can, that a little piece of paper laid on the balance will keep the watch from going, till it be removed ... The dissolving of silver in aqua regis and gold in aqua fortis and not vice versa would then perhaps be no more difficult to know than it is to a smith to understand why the turning of one key will open a lock, and not the turning of another.²²

Here, instead of a mechanical analogue for physical and even biological processes, Leucippus and Democritus use a biological analogue for physical processes.²³ Sextus Empiricus tells us that:

There is an old view which, as I said previously, has long been prevalent among the *phusikoi*, that like recognises like. Democritus confirmed of this opinion and Plato spoke of it in his *Timaeus*.²⁴ Democritus founds his argument on both animate and inanimate things. For animals, he says, flock with animals of the same kind – doves with doves, cranes with cranes, and so with the other irrational animals. Similarly in the case of inanimate things, as can be seen from seeds that are being winnowed and from pebbles on the sea-shore. For in the one case the whirl of the sieve separately arranges lentils with lentils, barley with barley, wheat with wheat; and in the other case, by the motion of the waves, oval pebbles are pushed into the same place as oval pebbles, and round pebbles as round pebbles, as though the similarity in things has some sort of ability for leading things together. That is Democritus' view.²⁵

As we will see in a moment, like to like is critical for the early atomists' account of cosmos formation. Is it a mechanical principle though? The like-to-like effect is explained in terms of both animate and inanimate metaphors contrary to mechanical philosophy. Whirling is agricultural rather than strictly mechanical, at least in the clockwork sense, and we might say something similar to the analogy with the sea and pebbles. It is interesting that Metrodorus of Chios, a pupil of Democritus, says that:

It is strange for one ear of corn to be produced in a great plain, and for one world in the boundless.²⁶

Here we have a biological comparison for the production of cosmosi. Leucippus and Democritus are not alone in this among the ancient atomists. Epicurus insisted that cosmosi grow from seeds.²⁷ Whirling is critical for Leucippus and Democritus as it generates cosmos formation. The key passage is from Diogenes Laertius:

Leucippus holds that the whole is infinite ... part of it is full, and part void ... from these, innumerable *kosmoi* come to be and are dissolved into these again. The cosmosi are generated in this manner. By 'cutting off from the infinite', many bodies of all shapes move into a great void, where they are crowded together and produce a single vortex, where colliding with each other and circulating in all manner of ways, they separate out like to like. When, because of their great number they are no longer capable of moving around in equilibrium, those that

are fine spread out into the outside void, as if sifted, while the rest hold together and becoming entangled, they unite their motions and create the first spherical structure. This stands apart like a membrane (*humena*), containing in itself all kinds of bodies. As they whirl around, due to the resistance of the middle, the surrounding membrane becomes thin, and the close packed atoms flow together due to touching the vortex. In this way the earth came into being, the atoms which had been borne in to the middle remaining there together. Again the surrounding membrane (*humena*) itself is increased, due to the influx of external bodies.²⁸ As it moves around in the vortex, it takes in whatever it touches. Some of the bodies which become entangled form a structure which is firstly moist and muddy, but which dries out as it revolves with the vortex of the whole, and then ignites to produce the constitution of the stars.²⁹

This process, although it looks straightforwardly physical and mechanical actually includes an important biological analogue as well. Twice here there is mention of a membrane, *humena*, in the process of cosmos formation. The Greek word here being most typically used of a membrane around the brain, heart or foetus. We have further evidence on this in that Stobaeus tells us that:

Leucippus and Democritus envelop the cosmos in a circular garment or membrane (*humena*) which comes about through the hook shaped atoms becoming entangled.³⁰

The membrane plays a critical role in cosmos formation and is also important for how cosmoi can have demarcation and identity criteria. They help to separate off a cosmos from the void and other cosmoi and are part of what give a cosmos its identity. Democritus also uses this biological analogue in relation to his explanation of hurricanes. Stobaeus tells us that for Democritus:

Hurricanes occur when a combination of fire and much void, held back in a place of much void and enclosed in its own membrane (*humenôn*), becomes an organised body due to their mixture and move violently to the depths.³¹

Leucippus and Democritus do use *humên* in biological contexts themselves, e.g. referring to the skull bone being more like a membrane in deer.³² None of this, as far as I am concerned, is to be in any way critical of Leucippus and Democritus. They used biological analogues, but as we have seen so did many of the presocratics and there is nothing invariant or beyond nature here. What I do think this does is narrow the gap somewhat between Leucippus and Democritus and some other presocratics in terms of explanation.³³ It also poses a problem for any historiography which values only purely mechanical explanations as there is no presocratic philosopher who supplies them to the exclusion of any other sort of explanation.

Leucippus and Democritus on forces

Did Leucippus and Democritus postulate universal forces acting at a distance? If they did not, did they think of like to like as a magical sympathy? In particular, Leucippus

and Democritus make use of a like-to-like principle in cosmogony. In many ways this is a typical principle of the ancient world. It is important to recognise that there is no force of attraction working at a distance here, in the sense of a force operating between like entities. All there is is a sorting principle. It requires the whirl for the process to take place. Democritus Fr. 164 is important here:

In the one case the whirl of the sieve separately arranges lentils with lentils, barley with barley, wheat with wheat; and in the other case, by the motion of the waves, oval pebbles are pushed into the same place as oval pebbles, and round pebbles as round pebbles, as though the similarity in things has some sort of ability for leading things together. That is Democritus' view.³⁴

It is critical in translating the last sentence not to introduce the word force in the translation. There is no word for force in the Greek, which simply talks of some capacity for bringing things together. Whether that is by some force which acts at a distance or due to some other effect should be left open. It is important here that motion is required for the like-to-like principle to come into effect. There is no suggestion here that if we leave a mixture of lentils, barley and wheat in a sieve,³⁵ that they will separate out without the sieve being whirled, or that similar stones on the beach will separate out if they are not agitated by the waves.³⁶ So this is not a Newtonian universal force whereby all pieces of matter attract all other pieces of matter at all times. Nor is it a sympathetic interaction which applies at all times. This is a sorting effect which occurs only when the sieve is being whirled or only when a vortex is formed in the void.³⁷ This should not surprise us as the atomist ontology makes no mention of forces at all, but simply has atoms and the void, as we saw above. So too the atoms are without character and we might conclude from that that they do not have forces operating between them. Stobaeus tells us that:

Democritus says that nothing is coloured in nature, as the elements are characterless (*apoia*),³⁸ both the solid and the empty.³⁹

On the related issue of weight, I take the view that weight is not an intrinsic property of the atoms for Leucippus and Democritus but that atoms only have weight in vortices.⁴⁰ If the like-to-like principle operates outside of the vortices, there is a serious difficulty. As there is no beginning to the universe for Leucippus and Democritus an unlimited amount of time has already occurred.⁴¹ So everything should have sorted like to like by now but it has not.⁴² So there is no like-to-like effect outside of the vortices.⁴³ Like to like for Leucippus and Democritus is a sorting principle operative when a certain form of motion is in progress. There are no forces or sympathies between atoms acting at a distance. Like to like can be construed in that manner, but was not by Leucippus and Democritus.⁴⁴

Leucippus and Democritus: theology

There is some evidence to suggest that Democritus believed in gods and the divine, though quite what sort of gods he believed in is complex. As ever, this type of evidence

is unclear and tangled, but our best source is probably Sextus Empiricus, who tells us that:

Democritus was wrong in that he explained the difficult in terms of the unbelievable. Nature gives a great many different starting points for how humans have come to a belief in the gods. That there are extraordinary human shaped images in what surrounds and all manner of things which Democritus imagines is entirely unbelievable.⁴⁵

Sextus Empiricus also tells us that:

Democritus says images approach humans, some being benevolent, some doing ill, so he prayed to meet good images. These are massive, extraordinary and difficult to destroy, though not indestructible. They prophesy the future to men by appearing and speaking to them. The men of old came to a belief in the gods from apprehending the appearance of these things, and other than these there is no god which has an indestructible nature.⁴⁶

Everyone is agreed that Democritus does not breach his basic ontology in his account of the gods and why men believe in them. Gods, if they exist, are not a different sort of substance to what is.⁴⁷ Also agreed is that for Democritus there are these *eidōla*, usually translated as images, which humans encounter. As in Democritus' theory of perception, these *eidōla* will be films of atoms. According to Democritus, objects give off a film of atoms and when we encounter these, perception occurs. Perhaps the simplest view, which has had both ancient and modern supporters, is that Democritus was in fact an atheist and what he did was to give an explanation of why some men come to believe in gods, without believing in gods himself. As Vlastos bluntly puts it:

I consider the *eidōla* to be an aetiological explanation of the popular belief in gods, and nothing more.⁴⁸

Cicero tells us that:

What of Democritus? Does he not go wrong in considering images and their wanderings as gods? ... As he denies anything is eternal, as nothing remains in the same state perpetually, he evidently removes the divine so completely that there cannot be any belief in it.⁴⁹

One point in favour of this view is that Democritus has been criticised for having a rather conservative view of the gods relative to other presocratic philosophers.⁵⁰ On one view, Democritus asserts that there are many gods, they are anthropomorphic and they have good or bad intentions towards humans.⁵¹ This is almost the sort of account of the gods which was criticised by Xenophanes and is very far from the sort of pantheism advocated by the Milesians. On the Democritus-as-atheist view though there are no gods which have these characteristics, merely *eidōla* which when some humans meet them, lead them into believing that there are gods with these characteristics. So we may meet with *eidōla* who are good or bad for us, but the *eidōla* do not have good or bad intentions. We may interpret meeting *eidōla* as in some way indicating the future, but the *eidōla* do not speak. The point is to explain why humans

have come to believe in gods with these characteristics, not to assert that there are such gods. Democritus then has a radical, atheist position which some would say is fully in line with his philosophical position on atoms and the void.

Barnes takes the view that the second Sextus passage above is actually about dreams and indeed *eidôlon* can have this psychological sense of an idea in the mind.⁵² This idea is attractive in that it can accept virtually everything the doxography has to say about the *eidôla* for Democritus (that there are many anthropomorphic gods with good or bad intentions who speak to us of the future, etc.) as they are merely ideas in our minds, like dreams and it is these dreams which led some to a belief in the gods. One problem with this view, as Taylor has argued,⁵³ is at least some *eidôla* are substantial and exist outside of the mind as they are a fundamental part of Democritus' theory of perception. The idea that *eidôla* can refer to something other, or more than physical images of the gods is an important one which I will return to below.

Eidôla and gods

The second view here is that the *eidôla* constitute the gods and so Democritus believes in the existence of the gods, though in a slightly attenuated manner. These gods though are entirely natural, being composed of atoms. That the gods are supposed to have intentions and morality is not a problem, as the mind for Democritus is distributed throughout the body. Any image given off by the body will include mind atoms as well and this might be thought to give the images intelligence and life. On this view, the images will have the standard characteristics of gods, there are many anthropomorphic gods with good or bad intentions who speak to us of the future, etc.

An interesting strategy here is to compare Democritus with Thomas Hobbes. Where Descartes supposed there to be three substances, matter, mind and god, reducing everything in the physical world to the size, shape and motion of atoms, later in the seventeenth century Hobbes went further and reduced mind and god as well, supposing there to be only one substance. Hobbes was accused of atheism. His defence was adamant and robust. He claimed to subscribe to everything in the Nicene creed. Hobbes also held that an incorporeal substance was inconceivable and could not exist. To believe that god was an incorporeal substance was problematic for Hobbes, as there simply were no incorporeal substances. So Hobbes believed he was a true theist in saying that god was composed of fine matter, as that was the only way in which god could exist. The parallels with Democritus are obvious enough. If all there is are atoms and the void, then if there are gods, they must be constituted from atoms.

One view we can decisively rule out for Democritus is that there are independent gods who give rise to the relevant *eidôla* that humans encounter. The final sentence of the second Sextus passage above would seem to weigh heavily against this and there is no need for there to be gods in Democritus' theory for there to be the relevant *eidôla*.

Some of this debate is going to depend on what we accept as genuine characteristics of the *eidôla* from the doxography. This is by no means straightforward as there are some very odd claims on the doxography which cannot be admitted, e.g. Stobaeus'

report that Democritus believed that god is mind in spherical fire or St. Cyril who says the same thing but adds that this is the soul of the world.⁵⁴ Exactly what we do accept is another matter, especially as the doxography is usually hostile to Democritus on this issue and very confused.

Democritus is perhaps better thought of in terms of what he did not believe in. He did not believe in the standard pantheon and he gave natural explanations for all the meteorological phenomena usually associated with such gods. He was not a Milesian pantheist, believing matter to be able to steer itself into a cosmos. Cosmoi are formed without any such guidance in Leucippus and Democritus. Nor did he believe in a god that has a mind/body relationship with the physical cosmos. Whether the *eidôla* explain a belief in the gods or in some attenuated sense are gods seems a smaller consideration in this context. Democritus was not placed in ancient lists of atheists, but such lists were notoriously unreliable.⁵⁵ I incline to Vlastos' view that the *eidôla* merely explain a belief in the gods. I see little in Leucippus and Democritus to suggest otherwise and am suspicious of the accuracy of the later doxography.

Eidôla: an alternative

I want to offer a different suggestion on the *eidôla* and again this is a targeting issue and Homer once again may be the target. *eidôlon* has a broader meaning than 'image' and can mean 'phantom' or 'ghost'. Homer makes significant use of the term in this sense. Throughout both the *Iliad* and the *Odyssey*, Homer uses *eidôlon* in relation to the ghosts, phantoms and wraiths which appear to the heroes at various stages and play an important part in the plot.⁵⁶ This is not to say that the *eidôla* are in themselves phantoms, or indeed ghosts or wraiths, but that they may explain human belief in such things, parallel to the Democritus as atheist view has the *eidôla* explain belief in the gods. Nor is this a claim that all *eidôla* are *eidôla* of ghosts, phantoms and wraiths but that some may be along with the *eidôla* of gods.

To go back to Barnes' suggestion that *eidôla* are dreams, or ideas in the mind, I would not want to rule this out either as long as we do not take this as an exclusive account of what all *eidôla* are for Democritus. There may be general and more specific targeting issues here. The more general one is what are dreams and where do they come from? The more specific one may be dreams in Homer, what they are and where they come from. Just as ghosts, phantoms and wraiths abound in Homer, there are many passages to do with dreams. Dreams in Homer may be beneficial or distressing; *Odyssey* IV/809, VI/49 has beneficial dreams while *Odyssey* XX/87 has a dream sent by some god for your distress. Dreams are usually from a god (*Odyssey* XIV/495).⁵⁷ Dreams may be deceitful or true as Penelope explains at *Odyssey* XIX/560, and one may have either dreams or waking visions as at *Odyssey* XIX/541. *Odyssey* IV/841 has dreams tied up with wraiths and the afterlife. At *Iliad* II/6 Zeus sends a dream to Agamemnon, at *Iliad* II/56 Agamemnon wakes with the voice of the dream still ringing around him and at *Iliad* II/80 he describes his dream. That dreams need interpretation is stressed at *Iliad* I/63 and V/149.

If Democritus does have this broad construal of *eidôla*, as encompassing not only images of what we take to be gods, but also of ghosts, phantoms and wraiths and also to be dreams or ideas in the mind, then this theory can do a great deal of interesting work for him, with some interesting Homeric targets. To go back to the Sextus passage we looked at earlier:

There are those who believe that we come to the idea of gods from remarkable things which happen in the cosmos. Democritus said that in relation to meteorological phenomena, the men of old, in relation to thunder, lightning and thunderbolts, the conjunction of the stars and the eclipses of the sun and moon, were afraid and believed there to be gods because of these things.⁵⁸

Democritus could explain belief in the gods without *eidôla*. *Eidôla* seem rather an extravagant notion just for another explanation of why humans believe in gods. One might then take the line that *eidôla* are gods themselves. Here is an important alternative. *Eidôla* are not gods but they explain belief in a great deal more phenomena than simply the gods. As we have seen in several places in this book, the natural explanation of dreams and dream divination was an important issue for some presocratic thinkers such as the Hippocratics, Xenophanes and Heraclitus.

Leucippus and Democritus on prayer

It is interesting, relative to what I argued about prayer in relation to the Hippocratics and Xenophanes, to note that Democritus advocated prayer. Plutarch tells us that:

Democritus, by praying to encounter good images, makes it clear that there are others which are difficult to deal with and have bad intentions and impulses.⁵⁹

The verb to pray here is *euchomai*, the standard verb for prayer in Homer and Hesiod. This though can hardly be intercessory prayer for several reasons. First inside a vortex and inside a cosmos, necessity prevails. Second, what is Democritus praying to? There are *eidôla*, but no gods who could override the necessity and certainly the *eidôla* themselves cannot override necessity. Prayer for Democritus might make sense if we understand it as a prayer of hope rather than entreaty. So 'I pray to meet good *eidola*' then means 'I hope to meet good *eidola*'. If Democritus does have something other than intercessory prayer to offer, that is important as a further example of the theory that presocratic intellectuals could devise a form of prayer appropriate to their own philosophical/theological beliefs rather than be stuck with the prayers of standard Greek religion. I take it as more likely that Democritus has an alternative to intercessory prayer and merely an explanation of religious belief than Democritus believed in gods who could intervene in the causal necessities of atomism and his prayers were intercessory.⁶⁰ It is also noticeable that, as with other presocratic intellectuals who rethought the notion of prayer, there is an absence of any mention of sacrifice in Leucippus and Democritus.

Leucippus and Democritus on the divine

Democritus does use the term divine and does so quite frequently. Democritus Fr. 112 says:

It is characteristic of a divine mind always to think of something good.⁶¹

Democritus Fr. 37 says that:

Those who choose the goods of the soul choose divine things, while those who choose the goods of the body choose human things.⁶²

I take it that this use of 'divine' is unproblematic, merely favouring the mental and the good over their alternatives without any sense that the divine involves a god or anything non-natural. Especially as:

Leucippus and Democritus and Epicurus deny that the cosmos is alive or that it has providential government, but is governed by some non-rational nature, and they hold that it is made of atoms.⁶³

Here we might be able to say something more about prayer for Democritus. Prayer might be something more than a hope to meet good *eidōla*, it might also serve to focus the mind on what is good. So prayer for Democritus may be about forming the right attitudes to choose to think of good things and to choose the goods of the mind. I note in relation to the Plutarch passage that Democritus was 'praying to encounter good images'. He was not specifically praying to a god or gods and that may be very significant.

Conclusion

There is a very strong case that Leucippus and Democritus gave only natural explanations, though as I suggested at the outset, this case is not quite so clear as one might expect from the atomist ontology of atoms and void.

Leucippus and Democritus certainly gave natural explanations of a wide range of meteorological phenomena, including the five Anaximander phenomena. It is notable that they attempted an explanation of incidences of plague, especially as that is prominent in Homer and Hesiod. It is also notable that they invoked the like-to-like principle without any reference to the gods where 'God always leads like with like' in Homer.⁶⁴

Leucippus and Democritus also had an explanation of how a belief in the gods came about, in an entirely natural manner, due, significantly, to fear of 'thunder, lightning and thunderbolts, the conjunction of the stars and the eclipses of the sun and moon'.⁶⁵ The theory of *eidōla* seems to be something more than another explanation of how humans came to believe in gods and to be an explanation of dreams and visions in general. If so, Homer may again be a significant target here given the role dreams and visions play in his work.

That Democritus referred to the divine is entirely unproblematic as it is clear he is referring to the good and the intellectual rather than to any god. It is significant that Democritus advocated prayer. It is also significant that the report does not have Democritus praying to a god and that prayer for Democritus can be related to his view that one should pursue the intellectual and the good. That is important for one of the themes of this book, that presocratic intellectuals could produce forms of prayer suitable to their own philosophical/theological beliefs and were not restricted to the types of prayer of ordinary Greek religious belief.

It is important to recognise that Leucippus and Democritus were not mechanists, if we mean by mechanists people who do not use any biological analogues for physical processes, let alone stricter conceptions of mechanism.⁶⁶ The like-to-like effect was based on biological and agricultural examples and there was an important role for a biological analogue, the notion of a membrane, in their cosmogony and cosmology. Nor did Leucippus and Democritus believe in forces acting between atoms. The like-to-like effect is a sorting principle which operates only when the requisite motion, in this case that of the vortex, is present.

Conclusion

At the beginning of this book, I set out a thesis and a critique to investigate. The thesis was that the presocratic philosophers attacked and entirely rejected the idea of the supernatural, believing what exists to be entirely natural and that proper explanations of phenomena should cite natural entities only. The critique was that the presocratic philosophers still believed in gods and the divine, that they believed in the efficacy of magical practices and that they indulged in animism, astrology, numerology, dream divination, magical healing and mysticism. I modified the thesis slightly, to include presocratic thinkers more generally and to substitute non-natural for the modern category of the supernatural. In one sense, the critique is correct. Virtually every presocratic thinker we have looked at believed in at least one item from the critique's list. Even Leucippus and Democritus, the supposed arch mechanists, employed biological analogues in explanation and had a place for gods, the divine and prayer. However, the critique in many places has proved to be ineffective. Some presocratics were able to generate entirely natural conceptions of gods and the divine. They were also capable of generating notions of prayer, piety and honouring appropriate to their natural conceptions of gods and the divine, different from the notions of standard presocratic religious beliefs. Some presocratics replaced non-natural explanations with natural ones. Supposedly non-natural phenomena were either denied or given natural explanations.

Summary

How large a group of presocratics were naturalists, that is, has an ontology consisting only of natural entities and explained phenomena citing only natural entities, once we take this critique into account? Certainly it includes Anaximander and Anaximenes of the Milesian thinkers. While they may think of nature as divine, intelligent and active in steering a cosmos into existence, their pantheistic conception behaves in an entirely regular manner. This group would also include those strongly influenced by Milesian thought such as Diogenes of Apollonia, though we have no real way of judging how many that might be. Thales is more difficult to judge as we have less information on him.

That Anaximander targeted Hesiod on meteorological phenomena is also highly significant, as other presocratics followed in his explanation of these five phenomena. If it is correct that presocratic thinkers targeted difficult, important and interesting phenomena and in particular targeted non-natural explanations in Homer and Hesiod then this adds a coherence and a context to their rejection of non-natural phenomena. It is not our conjecture that non-natural explanations were implicitly denied, we have evidence that non-natural explanations were specifically targeted.

With the Hippocratics, *On the Sacred Disease* rejected a special, non-natural status for epilepsy and had a general attack on magic. If the author was a pantheist, as seems very likely, then their comments on piety and atheism are unproblematic for a naturalistic interpretation of that work. With *On Regimen*, I have argued that the macrocosm/microcosm analogy used there, the recommendation for prayer and the analysis of dream prophecy can all be taken as natural. While there can be no doubt about the macrocosm/microcosm analogy, non-natural views of the prayer and dream prophecy passages are possible. Here we have a game within a game. How many of the Hippocratic authors held entirely natural views? If the author of *On Regimen* did not, that does not compromise the other Hippocratic authors. This is important in broadening the naturalist group beyond the orthodox canon of presocratic philosophers.

Xenophanes, Heraclitus and Anaxagoras I have argued were all naturalists. So too the author of the Derveni papyrus, who attempted a naturalistic reading of Orphic theogony, parallel to contemporaneous attempts to read Homer and Hesiod in the same manner. The historian Thucydides also seems to have been a naturalist as well. In the plays of Aristophanes and Euripides, characters are given naturalist views, sometimes in contrast to non-natural views. While we cannot discern the views of Aristophanes and Euripides themselves, the way that they present these views is suggestive of knowledge, debate and diverse views on these topics among their audience. Again, this is important in going beyond the orthodox canon of presocratic philosophers.

The source material on Pythagoras and the early Pythagoreans is so complex and contested that it is difficult to come to firm conclusions, especially about Pythagoras himself. What I think we can say is that Philolaus and Archytas were naturalists. How widespread that was among other early Pythagoreans is almost impossible to tell, especially as early Pythagoreanism seems to have been such a diffuse phenomenon. Philolaus' numerology proved to be a good example of the interesting ground that can be found if we reject the bi-polar characterisation of magic and science and are willing to recognise such ground.

Empedocles' work is highly complex and there is as yet no consensus on how it might be seen as a unified whole, or indeed even that it can be seen as a unified whole. It is possible to produce a fully naturalistic interpretation of Empedocles. In favour of that are Empedocles' strongly natural accounts of cosmogony, zoogony and the cosmic cycle which might be thought to encompass all phenomena. Against is the fact that there are significant tensions in the naturalistic account, plausible non-natural interpretations of some passages and Empedocles' attitude to Homer, which seems at variance with other presocratic naturalists.

Leucippus and Democritus might at first sight seem obvious candidates as naturalists. Ultimately I have argued they are naturalists, but we have to take on board

that they used biological analogues in their physics, that there is a debate about the nature of the gods for them and that they did have a conception of prayer.

There is then a significant group of presocratics who were naturalists – philosophers, medical writers, historians and it would seem from the attitude of playwrights such as Aristophanes and Euripides, some of the populace as well. Some cases are more clear-cut than others. There is a solid core here, though there are competing natural and non-natural views for the author of *On Regimen* and for Empedocles. Even without these two though, there is a significant group.

The naturalists

What we do with this group who rejected the non-natural is another matter. As I mentioned in the introduction, I do not see the establishment of such a group of presocratics as part of a simple myth to reason narrative, nor part of a supposed ‘Greek Enlightenment’, nor as part of a Greek ‘miracle’. Naturalism may be an important contribution to our thinking about nature but it is not a unitary origin for science. I do not want to argue that there was an exponential or even linear increase in either size or influence of this group of naturalists. It is quite possible that their size or influence at times declined.¹ That they existed and had some form of coherence is the simple conclusion of this study. The conclusion here needs to be judged against the critique of the presocratics rejecting the non-natural. That critique is substantial both at a historiographical and a specific level as I discussed in the introduction. It is important to have examined evidence of religious or magical belief that has been either marginalised or ignored in some studies. It is also important to have engaged with that critique historiographically.

I would emphasise that this group of presocratic naturalists is not co-extensive with the standard canon of presocratic philosophers. It includes several more people, many, if not all of the Hippocratic writers, further medical writers like Alkmaeon, the commentator on the Derveni Papyrus and perhaps more in their tradition, Thucydides, possibly some playwrights and elements of their audiences and may exclude Pythagoras, some early Pythagoreans and Empedocles. Whether ultimately we exclude Pythagoras and Empedocles, that there is a debate confirms that we need to look at the presocratics carefully on a case by case basis, and that applies to broad groups like the presocratic philosophers and smaller groups such as the Hippocratics and Pythagoreans.

This book has not been an attempt to ‘cleanse’ the presocratics of a belief in magic, gods or the non-natural. Many presocratics, in the sense of Greeks living before Socrates, believed in all of these. Nor has this book been an attempt to cleanse the presocratic philosophers or intelligentsia more generally of a belief in magic, gods or the non-natural. Many had theological beliefs, though in some cases that merely served to confirm their belief in a fully natural cosmos. Some believed in or addressed magical views. This book has been keen to seek out, attribute and analyse such views, more so than standard accounts of the presocratics. However, on analysis there is

a very good case that a significant number of presocratic thinkers were not only naturalists, but also, if the targeting thesis is correct, actively rejected the non-natural.

Anaximander and targeting

In addition to the main natural/non-natural issue, I would like to say something in conclusion about some of the more innovative sub-theses of this book. If the Anaximander passage which gives natural explanations for thunder, lightning, thunderbolts, hurricanes and typhoons is an allusion to a famous passage in Hesiod where these phenomena are explained in terms of the gods, then there are some very important consequences. If there is deliberate allusion to Hesiod, then there would seem to be intentional rejection of Hesiod. Deliberate allusion would set a context of polemic, of the new natural thinkers setting themselves against the non-natural views of the poets. It would also show the natural explanation of meteorological phenomena to be a central concern of Anaximander and later presocratics, rather than just a concern of the doxographers. Furthermore, as I hope to have shown, there is an extensive tradition among the presocratics of giving natural explanations for these 'Anaximander phenomena'.

Of course there is a big 'if' here, which is if Anaximander alluded to Hesiod. Perhaps the doxographers have their category of these five phenomena and fit the otherwise disparate view of Anaximander into this category. Although nothing can be proved here, I believe the balance of the evidence to be in favour of Anaximander alluding to Hesiod. The five phenomena form a slightly odd group, odd both in itself and as a doxographer's category. What are the chances of the doxographers coming up with these five phenomena which match the five phenomena in a famous Hesiod passage by accident? The history of the category in doxography goes back to Aristotle's *Meteorology*. Is it coincidence that Aristotle treats these five phenomena together or is he drawing on a presocratic tradition which did so? The group does have a strong coherence for Anaximander as he believed that all of these phenomena could be explained in terms of wind. If Anaximander did allude to Hesiod, that fits into a broader pattern of presocratic targeting of Homer and Hesiod on other issues of non-natural explanation. Indeed, Anaximander's view that the *apeiron* is undying and unaging may allude to Homer's description of the gods and the extant fragment may allude to Theognis in particular and the poets more generally on the order of the world.

That there is this pattern of targeting is undeniable given the evidence we have seen. That individual presocratics alluded to Homer and Hesiod is of course no great surprise. Scholars of individual presocratics will perhaps not be surprised that their man alluded to Homer and Hesiod, but may be more surprised at the extent to which other presocratics did and the systematic way they seem to target non-natural phenomena. The Hippocratics on the aetiology of disease is clearly a lead example, but we have seen other examples among the Hippocratics too, with allusions to how Hesiod classified cities, to Homer and Hesiod on how skills and medical knowledge

are acquired and to Homer on the nature of mental illness. Xenophanes is a mine of examples as well, with the out and out criticism of Homer and Hesiod on the gods, his explanations of the rainbow, St. Elmo's fire and the behaviour of the sun and moon, his outright rejection of divination and the way he mimics the way that Homer ends lines but leaves out references to the gods. So too we have seen the author of the Derveni papyrus provides an interesting example of an author trying to treat an Orphic theogony as a veiled natural theory and trying to tease a natural theory from the Orphic 'riddles'. Anaxagoras did not only target Homer, but was also perceived by others to target Homer. He gives natural explanations of many meteorological phenomena and a natural explanation for a goat with one horn. Heraclitus too gives a critique of religion and natural explanations for the five Anaximander phenomena and a rejection of dreams and divination as a source of knowledge as well as an important emphasis that neither gods nor men made this entirely orderly cosmos. Leucippus and Democritus, apart from their account of how belief in the gods came about in the first place, also seem to allude to Homer on the issues of *eidôla*, and the like to like principle.² Finally, if it is the case that Anaximander alluded to Hesiod on the five Anaximander phenomena, then it is highly likely that all the other presocratics who discussed these five phenomena understood the nature of the allusion and the targeting as well, fitting into the same polemical context. If they were making other allusions to Homer and Hesiod as well on the issue of the non-natural, as I have argued, this seems even more likely. That would include at least Anaximenes, Heraclitus, Anaxagoras, Leucippus and Democritus. Rejection of the non-natural is the polemical context, rather than being incidental to the polemical context.

The Hippocratics, pantheism and religious practice

The idea that we can attribute some form of pantheism to the Hippocratic author of *On the Sacred Disease* and so understand why they say that all diseases are both divine and natural is not new. However, the idea that we can understand the comments on piety and ritual within a naturalistic pantheism is new. There is no reason why ancient pantheists could not honour god/nature, be pious towards god/nature, criticise atheists or have rituals and have a notion of what it would be to be impious. Critically, pantheists can pray as well if we understand prayer to be about changing our own mental states rather than always being an entreaty for an independent god to intervene in the world. Xenophanes is an important example here.

This has important consequences both for understanding the Hippocratics and for understanding other presocratic thinkers. There is no need, in building a case for a belief that everything is natural for some of the presocratics to marginalise, ignore or attempt to explain away religious belief or practice.³ They may believe in an entirely natural god and these thinkers were quite capable of generating religious practices such as prayer for the sake of their own mental state in line with that belief in a natural god. We cannot then assume that when prayer is advocated in the Hippocratic *On Regimen* that this is prayer to an independent god to intervene. We have seen prayer

in other contexts for intellectuals, with Xenophanes, Aristotle, Epicurus and Cleanthes where it is clearly not petitionary. I have also offered an alternative reading of the passage on 'divine' dreams in *On Regimen* such that this passage is then an attack on charlatans who succeed in prophecy by chance, rather than an affirmation that 'divine' dreams exist.

There has been criticism of what has been termed the 'explanatory vacuity of pantheism'.⁴ This is unjustified and I hope I have been able to show that this is not the case for Greek pantheists who believed that nature has some form of inherent 'steering' function which allows the cosmos to be formed from some prior state of the universe.⁵ Without that steering a single well-ordered, beautiful world that is a cosmos would not form for the pantheists. One conclusion of this book is that forms of pantheism were more widespread among early Greek thinkers than is usually thought and is important in helping to underpin a view of the world as an entirely natural entity. Historiography has moved on from ideas of inevitable conflict between science and religion. There is no tension here between the view that the world is divine and the world is natural, and there is no inhibition of the investigation of nature.

In the introduction to this book, I included a brief section on Greek magical practice. I wanted to give some indication of Greek magical practice so we could have some comparison not only with the theories of the presocratic intellectuals but with their practice as well. That is important as a check on consistency, that theory matches practice. It is also important in marking out just how different the presocratic naturalists were from the magic of the Greek populace and the magic described in Homer and Hesiod. It is important to say something similar about religious practice. It is important as a check on consistency for the presocratic naturalists and important in marking out just how different their religious practices were from the presocratic Greek populace.

The Pythagoreans and numerology

It is important that we are able to differentiate between various forms of numerology. The literature has not done so adequately and in many cases has not even tried to do so, sometimes driven by a historiography which treats anything outside of mathematics and mathematical physics with the deepest suspicion. Often all forms of numerology are grouped together (and dismissed together) as equally foolish, mysterious or superstitious. This is unfortunate, as there are significant differences between modern numerology and what I have termed superstitious numerology, arithmology, number mysticism, number symbolism and cosmic numerology. Once we have this in mind, we can then have a much more nuanced discussion of the early Pythagoreans and numerology.

Certainly there are continuities between the superstitious numerology of earlier cultures and what some of the early Pythagoreans say, but against the view of Burkert, who has a polarity of the scientific use of mathematics against superstitious numerology, this is not all the early Pythagoreans have to say. They employed a cosmic

numerology, with epistemological and cosmological motivations. While this was far from modern science, it was significantly different from the primitive numerology of earlier cultures and went significantly beyond ethical, symbolic or aesthetic considerations as well.

One theme of this book has been that we should avoid historiographies of magic which make a bipolar distinction between magic and science and this is well illustrated by the Pythagoreans on numerology. There is much that is possible between these supposed polarities in terms of natural magic and that is important for understanding presocratic attitudes to magic and to the natural. I have made largely the same point about religion as well. We need to be able to understand the interesting positions that combine religious belief and naturalism or the investigation of the natural rather than simply treat those as polar opposites or in some sense incompatible.

Finally then, there was something that can meaningfully be termed presocratic naturalism and there was a group of presocratic naturalists. That group is not co-extensive with the canon of presocratic philosophers but is substantial.

Notes

Chapter One

- 1 See Saler (1977) p. 34.
- 2 Dodds (1951).
- 3 See below on the issue of rationality. I would agree with Fowler (1995) p. 5 that: 'It is true that philosophers developed rarefied notions of religion, but they were not at all typical. The universal and commonplace acceptance of magic, among all classes, is easily proved from the evidence.'
- 4 Pingree (1992), von Staden (1992).
- 5 See the section below on 'elisions'. Cf. Fowler (1995) on the way that some historiographies of religion have marginalised or excluded magic.
- 6 Jaeger (1947) v.
- 7 See Pingree (1992) and especially von Staden (1992).
- 8 See Lloyd (1991) p. 417.
- 9 Van der Eijk (2011) p. 21ff. Van der Eijk looks at reasons why classicists and medical historians might think it important to defend the rejection of the supernatural view, which would equally apply to philosophers/ancient philosophers in relation to presocratic philosophers.
- 10 I translate *phusis* as nature here for simplicity, see below on *phusis* and these terms.
- 11 See Lloyd (1991).
- 12 Following the italics of Lloyd (1991) p. 417. Vlastos, a strong supporter of the rejection of the supernatural view asked, 'What were they fighting against, and what were they fighting for?'; answering that they fought against the supernatural and for the notion of cosmos; Vlastos (1975) xii.
- 13 Lloyd (1991).
- 14 We can ask similar questions of the material on the presocratics that can be found in Plato and Aristotle themselves.
- 15 Stobaeus and Pseudo-Plutarch, two of our most important sources, give a heading (such as 'Concerning the moon') then a list of views about the moon with little broader context for those views.
- 16 See Vlastos (1975) p. 18, Lloyd (1991) p. 417, Martin (2004) p. 14.
- 17 Martin (2004) p. 14.
- 18 Martin (2004) p. 15.
- 19 Kingsley (1995).
- 20 Dodds (1951), Kingsley (1995).
- 21 West (1971) p. 77 expresses this often-made point most clearly in relation to Anaximander.
- 22 Cornford (1952), West (1971), Stokes (1963), cf. Graham (2006), Gregory (2007).
- 23 Lloyd (1991).
- 24 Edelstein (1967), van der Eijk (1991), Fowler (1995). Gomperz (1922) is the classic statement of the 'natural' case, Hankinson (1998) has a good balanced view.

- 25 Martin (2004) pp. 36ff., esp. 49–50.
- 26 Burkert (1972), Huffman (1999a), Zhmud (2012).
- 27 Dodds (1951), Kingsley (1994).
- 28 Kingsley (1994).
- 29 Burkert (1972) and variations on this view are widely held.
- 30 Some examples are that *On Purifications* was written earlier or later than *On Nature*, with *On Nature* representing Empedocles' mature thought, *On Purifications* representing foolish youth or old age. If taken contemporaneously, we treat *On Purifications* as allegorical and interpret it in terms of *On Nature*. See Guthrie (1965) p. 124.
- 31 The recently discovered Strasbourg papyrus gives us new information on Empedocles where supposedly 'scientific' and 'religious' elements occur in the same fragments. See Trepanier (2004). In particular, developments in the historiography of the relation of science and religion (see below) have thrown doubt on the basis of distributing the fragments into two poems categorised as 'science' and 'religion'. According to Kingsley (1995) p. 8, such an approach is 'not only inappropriate but completely untenable.' Cf. Inwood (2001) p. 8.
- 32 Kingsley (1994).
- 33 Natural theology can have another sense, that of philosophical arguments for a god (natural or supernatural) as opposed to divine revelation.
- 34 There is no plausible means of transmission for astrological influence, the proposed division of the sky is entirely arbitrary, there is no evidence to support the claims of astrology.
- 35 The shift away from alchemy began in the seventeenth century and it has been of no more than marginal interest since the chemical revolution of the eighteenth century.
- 36 There can be nuclear fission and fusion generating different elements, both as something exploited by humans and as an important part of the evolution of the universe, given that the Big Bang produces only Hydrogen and Helium in any significant amounts and the other elements are generated by a process known as stellar nucleosynthesis.
- 37 Important here are 'Barnum' statements which apply to everyone but are in fact very vague ('you went through a difficult stage around the time of puberty') and the Forer effect (Forer 1949), which is the well-attested tendency for people to consider groups of Barnum statements to be accurate even though the individual statements are vague or meaningless. Many stage magicians are highly skilled at audience misdirection (you are made to look elsewhere to conceal the trick being done) and giving subliminal messages to audiences or volunteers helping them with their tricks.
- 38 There is no plausible theoretical foundation for modern popular numerology nor is there a shred of empirical evidence to support it.
- 39 Not surprisingly, but highly implausibly, water is supposed only to retain the sorts of memories deemed important by those who believe in water memory, not all sorts of other memories. One might also note that those who believe in reincarnation always seem to have led surprisingly interesting past lives!
- 40 See <http://www.randi.org/site/>
- 41 KRS (1982).
- 42 Barnes (1983).
- 43 McKirahan (1994).
- 44 Graham (2010).

- 45 Dodds (1951), Lloyd (1987) and others have demonstrated that there was no simple, unidirectional move from myth to reason in ancient Greek thought. Buxton (1999) is a good collection of papers, also see Rochberg, Pingree, von Staden, Bernal and Lloyd in *Isis* 1992.
- 46 Accounts of the 'Greek Enlightenment' often seriously overplay the extent to which the European Enlightenment of the eighteenth century adopted a mechanical atomism or a secularist/ atheist approach, do the same for the ancient Greeks and often use an outdated conflict historiography of religion and science. On the Greek (or 'Ionian') Enlightenment see Solmsen (1975), Guthrie (1969), Penrose and Schrodinger (1996). On the European Enlightenment see Hankins (1985).
- 47 See Rochberg, Pingree, von Staden, Bernal and Lloyd in *Isis* 1992.
- 48 Greek philosophy/science did not arrive as a 'Traveller without luggage' as Vernant (1965) p. 343 puts it. The notion of 'miracle' is unhelpful in several ways, from promoting the idea that change occurred rapidly, cleanly and without precursors, with Greek science/philosophy emerging fully formed, to promoting the idea that change in this period is inexplicable.
- 49 Although Dodds is rightly famous for this work among classical scholars, Thorndike had expressed similar ideas some year earlier – see his *History of Magic and Experimental Science* (1923) vol. 1 pp. 20–2.
- 50 Dodds (1951) viii.
- 51 See below.
- 52 As I am interested in how many presocratics, rather than how many presocratic philosophers, recent debates about who should be in the canon and how and why we construct such a canon are not so important here. On the canon of presocratic philosophy see Laks and Louguet (2002).
- 53 Classic anthropological studies here are Canon (1942), Levi-Strauss 'The Sorcerer and his Magic' in his *Structural Anthropology* (1963), Levy-Bruhl (1979); see also Horton (1967 and 1993). See too Durkheim (1965) pp. 40ff.
- 54 I teach an undergraduate course on the history of the relation between science and magic. I begin by asking my students whether they believe in anything they consider to be supernatural, magical or paranormal. The usual response is for around half of them to put their hands up. I then ask them what is it about what you believe in that makes it in some way other than the natural?
- 55 Supernatural also has a specific technical meaning in Catholic theology.
- 56 Indeed, for Aristotle there is a sense in which the heavens are more natural, as they always, without exception do what is natural to them, unlike the elements in the terrestrial realm.
- 57 Cf. Campion (2008) p. 139, who contrasts the Ionians who were 'primarily interested in natural causes' with the Eleatics who were 'more concerned with what we would regard as metaphysics', or 'super-naturalism'. Clearly there is an important distinction here, but I would not consider Eleatic metaphysics as supernatural in the senses I have outlined, not least because Eleatic metaphysical entities (like those of Plato) are unchanging and therefore invariant.
- 58 See Vlastos (1975) p. 18, Lloyd (1991) p. 417, Martin (2004) p. 14.
- 59 So if I throw a stone upwards, the stone moves *para phusin*, in that stones naturally move to the centre of the cosmos, but nothing supernatural has occurred.
- 60 Saler (1977) p. 38.
- 61 Saler (1977) pp. 34–5.
- 62 LSJ.

- 63 *Phusis* is related to the Greek verb *phuein*, to grow.
- 64 LSJ.
- 65 See e.g. Lovejoy (1909), Jaeger (1947) p. 20, Sandbach (1975) p. 31, Curd (1998) pp. 45–7 and especially Naddaf (2005), though also see Naddaf (2005) pp. 17ff. on different readings of *phusis*. Cf. Aristotle *Metaphysics* IV/1015aff. For some dissenting opinions see Kirk (1955) p. 228 and Mourelatos (1970) pp. 62–3.
- 66 In Plato's *Timaeus* we also find stoichogony, the study of the origins of the elements.
- 67 See e.g. Aristotle *Physics* III/4, 203b15.
- 68 Aristotle, *Physics* I/4, 187a12.
- 69 Plato, *Phaedo* 96a8, cf. e.g. Simplicius, *Commentary on Aristotle's Physics*, 154, 17.
- 70 I will argue that none are mechanists in the strict sense of the term, of applying exclusively mechanical processes to nature. Even Leucippus and Democritus use biological and agricultural analogies.
- 71 See Gregory (2007) Ch. 1. An important example here is that the attribution of soul to the heavenly bodies is done to guarantee their regular motion. Soul allows them to generate their own motion, intelligence to choose the right motion every time, see Ch. 2.
- 72 Lloyd (1991) p. 417, cf. pp. 431–2.
- 73 See Lloyd (1991) p. 419.
- 74 I try not to phrase this in terms of 'laws of nature' which has too many modern connotations not applicable to the ancient world.
- 75 Lloyd (1991) p. 418.
- 76 Homer, *Odyssey* X/302ff. See Naddaf (2005) pp. 13–14 for *phusis* in Homer.
- 77 Lloyd (1991) p. 418, (2003) p. 48.
- 78 I have used the neutral term 'generate' here. Lloyd (1991) pp. 431–2 considers the presocratics to have invented rather than discovered nature (unlike Columbus finding America). Invention/discovery is a hotly disputed area but I will just outline another view, which draws some distinctions and contrasts here. The presocratics invented the content of their theories of nature. However, they discovered nature in the sense that nature excludes the non-natural. They also discovered that nature is invariant.
- 79 See Homer, *Odyssey* V/128, VII/249, XII/387, XII/415, XIV/305, XXII/330.
- 80 See Hesiod, *Theogony*, 663ff., see especially 690ff. and 845ff.
- 81 Giambattista della Porta, cf. Cornelius Agrippa *De Occulta Philosophia Libri Tres*, Marsilio Ficino *De Vita Libri Tres*, etc.
- 82 Della Porta (1598), Preface.
- 83 See e.g. the list of subjects dealt with in della Porta's *Natural Magic*.
- 84 Frazer (1917) p. 52.
- 85 Criticised for it as well by the mechanical philosophers of the seventeenth century, for whom contact action was the only possible interaction, Descartes and others having accounts of gravity based on contact action only.
- 86 Plotinus, *Enneads* 4, 4, 40.
- 87 Later in antiquity Bolus (pseudo-Democritus) is a very good candidate for analysis as a natural magician? See Kahn (2001) p. 141.
- 88 So Rufus Fr. 90 believed amulets to have natural effects and Galen believed one amulet to have a natural effect. See Lloyd (1979) pp. 42–3.
- 89 Vlastos (1952) p. 119. Cf. Lloyd (1979) p. 11, Jaeger (1947), Hussey (1972), Trepanier (2010).
- 90 Trepanier (2010) p. 276.
- 91 See here e.g. Frankfort (1946), Vernant (1965).

- 92 See Gregory (2007) Ch. 1.
- 93 St. Augustine, *City of God*, VI/5.
- 94 Cf. Gerson (1990) p. 1.
- 95 Dawkins (2007), 40.
- 96 The Bible has quite a lot to say about magic. Magic exists, it works and notoriously, at Exodus 22.18, the King James translation gives 'Thou shalt not suffer a witch to live'. To give some further examples, Numbers 22.7, 23.23, is Jehovah's condemnation of divination. Deuteronomy 18.10–15, Jehovah's condemnation of augury and necromancy, Leviticus 19.31, 20.6, 20.27, Jehovah's condemnation of mediums and wizards, Exodus 7.8–20, Jehovah's condemnation of enchanters and shape changing. In the apocryphal Book of Enoch, astrology is taught to men by fallen angels, who have taught them charms and enchantments, meteorology, the signs of the sun and moon. With the tale of Saul and the Witch of Endor (1 Samuel 28.8–26), King Saul banishes soothsayers and diviners from Israel, but still felt the need for their guidance, and consults the witch of Endor who summons the spirit of the dead Samuel. In Exodus 7.8–12, when Aaron and Moses visit the Pharaoh, three pagan enchanters turn their rods into snakes. The central question for the early Christians is how to separate the true miracles worked by God and Jesus Christ from the works of Pagan magicians. Simply denying the efficacy of Pagan magic is not an option, for there are several biblical references to it. The early church also has to counter the view that Christ was a magician, and not divine.
- 97 Draper (1874) and White (1896) are the classic statements of the conflict thesis, and it is perhaps worth quoting their respective titles, *History of the Conflict between Religion and Science* and *A History of the Warfare of Science with Theology in Christendom*. The conflict thesis is now seen as something constructed out of the concerns of later nineteenth-century science and the specific concerns of Draper and White, see Brooke (1991) and Dixon (2008) for comment and the new complexity theory.
- 98 See Brooke (1991), Dixon (2008).
- 99 There is very little evidence in the ancient world that Empedocles wrote two poems or that they were divided along these lines. See Ch. 9.
- 100 Von Staden (1992). Cf. Lloyd (1987 and 1992), Rochberg (1992), Pingree (1992), Bernal (1992).
- 101 Von Staden (1992) p. 584.
- 102 Diels first published *Die Fragmente der Vorsokratiker* in 1903, revised by Kranz 1937 and 1952, usually known as Diels-Kranz.
- 103 Gallop *Parmenides* (1986), Robinson *Heraclitus* (1987), Leshner *Xenophanes* (1992), Taylor *Leucippus and Democritus* (1999), Inwood *Empedocles* (2001) Curd *Anaxagoras* (2007). De Gruyter are also beginning to bring out what looks as if it will be an excellent comprehensive series on the presocratics.
- 104 In Gregory (2007) I argue that Aristotle has some misconceptions about presocratic cosmogony which can be seen seriously to affect the later doxographic tradition on the subject.
- 105 The watershed for modern studies and what to accept and not accept as evidence in relation to the early Pythagoreans here is Burkert (1972).
- 106 Van Groningen (1956) pp. 47–61; see Kingsley (1995) p. 219 for critique. On the view that Empedocles wrote two poems, privileging the 'scientific', *On Nature* over the 'religious/magical' *Purifications* can also be seen as a form of elision. See Dodds (1951) pp. 145–6.

- 107 Kuhlewein (1898) II, p. 9, note 1; see Hankinson (1998) p. 18 for critique.
- 108 The latter seems extreme, but was employed in relation to Newton and alchemy. See Fauvel (1989).
- 109 Dodds (1951).
- 110 As we will see though, the interpretation of *On the Sacred Disease* is hotly contested.
- 111 Collins (2008) p. 2.
- 112 Nor are the origins of Greek thinking about magic of any great interest here, or the extent of influence of other civilisations on Greek magic.
- 113 Collins (2003) p. 17.
- 114 See Fowler (1995) for a discussion here. Nor is this book interested in why magical beliefs came about and why they perpetuated. See Lloyd (1979) p. 6ff.
- 115 I appreciate some philosophers in particular will find this frustrating – define magic, they will say, so we know precisely what it is. However, not only is that not easy (which should not stop us), it is not, as generations of magic scholars have found, very helpful, either philosophically or historically.
- 116 I also want to dissociate myself from any view which has societies developing through a movement from magic to religion to science.
- 117 Levy-Bruhl (1979) p. 327.
- 118 Dodds (1951) pp. 10–11.
- 119 Homer, *Iliad* XIX, 86ff., see Dodds (1951) pp. 2–3, cf. Vlastos (1973) p. 13 for a discussion of Dodds on *atê*.
- 120 Draper (1874) and White (1896) are the classical statements of the conflict theory, Brooke (1991) and Dixon (2008) are good introductions to the new complexity model.
- 121 The papers in Fauvel (1989) are a good example of this.
- 122 Xenophanes, Fr. 11, cf. Fr. 12.
- 123 Homer, *Odyssey* XI, 25ff.
- 124 Hesiod's *Works and Days* 109ff.
- 125 See my Ch. 4 for further discussion.
- 126 Collins (2008) pp. 104ff.
- 127 Kingsley (1995) pp. 281ff.
- 128 Graf (1991) pp. 118ff., Dickie (2001) pp. 17–18, Collins (2008) pp. 64ff., Ogden (2009) pp. 227ff.
- 129 Collins (2008) pp. 88ff.
- 130 Ogden (2009).

Chapter Two

- 1 See Copenhaver (1988) p. 266 and p. 287, Cf. Copenhaver (2003), Kieckhefer (1989), Schumaker (1972).
- 2 Dodds (1951) p. 246.
- 3 Murray (1955), p. 144.
- 4 See e.g. Aristotle *Physics* 198bff., *Metaphysics* 1027aff.
- 5 Aristotle, *On the Heavens* II/14, 296a33ff. is particularly emphatic on this.
- 6 Aristotle, *On Generation and Corruption* 337a8–16.
- 7 Aristotle, *On Generation and Corruption* 337a2–7.
- 8 Aristotle, *On Generation and Destruction* II/10, 336a33–4.

- 9 Actually the motion of the sun is a little more complex for Aristotle, following Eudoxus and Callippus, but these two are the dominant motions.
- 10 Aristotle, *On Generation and Destruction* II/10, 336b7–14.
- 11 Aristotle, *On Generation and Destruction* II/10, 336b16.
- 12 Aristotle, *Meteorology* I/2.
- 13 Presocratic thinkers had commonly used it in cosmogony, as we will see in the next chapter, describing how the world had been ‘steered’ into being an ordered cosmos from a primordial chaotic state. Other presocratics use *kratein* and its cognates to similar effect. Later astrologers used it for the influence the heavens had on human affairs. Other presocratics use *kratein* and its cognates to similar effect.
- 14 Aristotle, *Meteorology* I/3, 340b12, cf. *On the Heavens* II/7 on the nature of the heavenly bodies.
- 15 Aristotle, *Metaphysics* XII/5.
- 16 Aristotle, *Generation of Animals* IV/10.
- 17 Aristotle, *Generation of Animals* II/4. Cf. *Investigation of Animals* VII/2: ‘The onset of the catamenia in women takes place towards the end of the month; and on this account the wiseacres assert that the moon is feminine, because the discharge in women and the waning of the moon happen at one and the same time, and after the wane and the discharge both one and the other grow whole again.’
- 18 Aristotle, *Investigation of Animals* V/12.
- 19 Ptolemy, *Tetrabiblos* I/1.
- 20 Ptolemy, *Tetrabiblos* I/2.
- 21 Ptolemy, *Tetrabiblos* I/2.
- 22 Bok, Kurtz and Jerome (1975) pp. 154–5, cf. Jerome (1975) p. 46: ‘astrology is false because it is a system of magic.’
- 23 Martin (2004) p. 247.
- 24 See the Leyden Papyrus (1974).
- 25 See e.g. *Meteorology* I/3, 339a37ff., cf. *On the Heavens* III/6 and III/7, *On Generation and Corruption* II/4 and II/5.
- 26 See Aristotle, *Generation and Corruption* II/10 and II/11.
- 27 Gold and other metals for Aristotle are combinations of earth and water, see e.g. *Meteorologica* III/6 or IV/10.
- 28 See e.g. *Meteorology* IV/8 384b24ff. and IV/10 388a10ff. on the constitution of gold and other metals.
- 29 Typically this was how ancient alchemists theorised their investigations. Francis Bacon later comments that ‘He who knows the forms of yellow, weight, ductility, fixity, fluidity solution and so on, and the methods for superinducing them, and their gradations and modes, will make it his care to have them joined together in some body, whence may follow the transformation of that body into gold.’
- 30 See *Meteorology* III/6, 378a17ff.
- 31 See *Meteorology* III/6, 378a17ff.
- 32 Democritus Fr. 34
- 33 Aristotle, *Physics* VIII/2, 252b24–7.
- 34 Aristotle, *On Generation and Corruption*, II/10, trans. H. H. Joachim.
- 35 As noted in the introductory chapter, sympathetic interactions are by no means necessarily non-natural.
- 36 Dodds (1951) p. 120 recognises the importance of Aristotle’s work on dreams, calls it ‘coolly rational’ and agrees that for Aristotle no dreams are god-sent.
- 37 Aristotle, *On Divination by way of Dreams* I, 462b 12–27, trans. Hankinson.

- 38 Aristotle, *On Divination by way of Dreams* I, 463a 3–6, trans. Hankinson.
- 39 *On Divination by way of Dreams* I.
- 40 *On Divination by way of Dreams* I, 463a32–b6, trans. Beare.
- 41 *On Divination by way of Dreams* II, 463b12–22, trans. Beare.
- 42 Hankinson (1998) pp. 26–7, cf. Huby (1979) p. 55.
- 43 Hippocratic author, *On the Sacred Disease*, V.
- 44 Aristotle, *On Divination by way of Dreams* II, 463b 12–15, trans. Hankinson.
- 45 Huby (1979) p. 55.
- 46 Pagel (1967), Debus (1970), Frank (1990), Wear (1990), French (1994), Rossi (2000), Fuchs (2001). Cf. McMullen (1998) and Lesky (1957) pp. 289–311, 349–78.
- 47 Harvey (1628), Ch. 8.
- 48 Harvey (1628), Ch. 8. See Aristotle *De Generatione et Corruptione* II/10, *De Anima* 415b3–8, *De Mundo* 399a20–35 for the Aristotelian background here. For Aristotle it is the sun that is the cause of the weather cycle – this is in the very strong Aristotelian sense of being both efficient and final cause – see *Meteorologica* 346b20ff.
- 49 Both Sachs a Lowenheimb and Nathaniel Highmore wrote works supporting the circulation and the macrocosm/microcosm interpretation of it. Both made use of illustrations of a macrocosm microcosm analogy involving the circulation and the weather cycle on their opening pages. Highmore (1651), Sachs a Lowenheimb (1664).
- 50 Harvey (1651), Exercise 50 pp. 234/5: ‘In this sense it is truly said that the Sun and a man beget a man, because spring and autumn follow the sun as it approaches or recedes, and at these seasons, for the most part, happens the generation of animals and their decay. So Aristotle, the chief of Philosophers’ Harvey proceeds to translate and quote Aristotle, *On Generation and Destruction* II/10.
- 51 Harvey translates and quotes Aristotle, *On Generation and Destruction* II/10.
- 52 Walleus, *De Motu Chyli et Sanguinis*, in *Anatomia ad sanguis circulationem reformata* Hagae-Comitis 1655, p. 790, Pagel’s translation.
- 53 Thunderbolts, here *keraiôn*, 80c1.
- 54 Generated by rubbing amber, here *êlectrôn*, 80c1.
- 55 The lodestone, here *tôn Hêracleiôn lithôn*, 80c1.
- 56 Plato, *Timaeus* 80b8–c4.
- 57 See e.g. Descartes’ *Principia Philosophia* gravity IV/20ff. Plato and Descartes appear to be in strong agreement on the inherent properties of matter. Matter has geometrical properties and motion, and no other properties. So for Descartes interaction between particles is by contact action only, and this serves to explain all attractive and repulsive effects that might otherwise be thought to operate at a distance, including the hard cases of gravity, electricity and magnetism.
- 58 Aristotle, *On Animals* I/2, 405a19.
- 59 Plato, *Laws* 933aff. Cf. Plato *Republic* 364bff. and *Laws* 909aff.
- 60 Plato, *Laws* 967b.
- 61 Plato, *Timaeus* 34a. The six motions are up, down, left, right, backwards and forwards.
- 62 Plato, *Timaeus* 40a.
- 63 Plato, *Phaedo* 97aff.
- 64 See *Timaeus* 28a–29d. Note that the cosmos for Plato is organised from a chaos, not created *ex nihilo*.
- 65 See Plato, *Timaeus* 47aff.
- 66 See Plato, *Timaeus* 88de.
- 67 See Plato, *Timaeus* 81ab.

- 68 Plato, *Phaedrus* 252cff.
- 69 See e.g. Dodds (1951) p. 245, n. 53.
- 70 Plato, *Timaeus*, 40cd.
- 71 See Gregory (2003). *parabolas* at 40c4 can mean side by side (and has the technical meaning of conjunction in later works, *sunapsesin* at 40c6 can mean in contact with, and *epiprosthen* at 40c7 before, in the sense of screen or cover. Plato may well be aware of these three separate phenomena. Plato would appear to be aware of retrogression. That would certainly be the most natural reading of *epanakuklêseis* at 40c5 in this context, a contrast to *proschôrêseis* at 40c5 indicating forward motion.
- 72 The inferior planets have orbits smaller than that of the earth, the superior planets have orbits larger than that of the earth.
- 73 Bruno, *De Rerum Princip.*, BOL 521.28ff. Cf. 524.7ff. esp. 9–10 and 524.22–5.
- 74 *De Rerum Princ.* 524.7–10.
- 75 *De Rerum Princ.* 524.23–4.
- 76 *De Immenso* 6/VIII, BOL 185.
- 77 See *De Rerum Princ.* 522.11–12.
- 78 See *De Rerum Princ.* 522.13ff.
- 79 See *De Rerum Princ.* 522.13ff.
- 80 See *De Rerum Princ.* 523.4–5.
- 81 See *De Monade*, BOL 347. For other comments in Bruno, see Pagel (1967) pp. 106–8.
- 82 It is important to note though that Plato, unlike Bruno and indeed Harvey does not associate the blood with soul, and in the *Phaedo* quite specifically denies that we think with the blood (or air or fire), possibly in reply to some presocratic speculation (see *Phaedo* 96b).
- 83 Saler (1977) p. 40: ‘Nor does the Artisan god of the *Timaeus* appear to be supernatural in any significant metaphysical sense.’

Chapter Three

- 1 Pseudo-Plutarch III, 3, 1.
- 2 Seneca, *Natural Questions*, II/18.
- 3 Hippolytus, *The Refutation of all Heresies*, 1, 6, 7.
- 4 Pseudo-Plutarch III, 7.
- 5 Vlastos (1952) cites Gilbert (1895) p. 292, nn. 3 and 5.
- 6 Vlastos (1952) p. 97. Vlastos cites Thucydides 7.50.4.
- 7 Lloyd (1970) p. 9.
- 8 Cf. Lloyd (1991) p. 420: ‘all we have is a natural explanation, is a rejection of non-natural explanation merely our conjecture?’
- 9 Kahn (1960) p. 99ff. finds little development in Greek meteorology once Anaximander gives naturalistic explanations, Taub (2003) p. 10 finds rather more. I tend to side with Taub, though I would locate the development to producing explanations of more meteorological phenomena (rainbows, St. Elmo’s fire, etc.) and to giving more detailed explanations consistent with the philosophical developments.
- 10 Lloyd (1991) p. 418.
- 11 Cf. Lloyd (1991) p. 421 on context for the Hippocratics.
- 12 Homer, *Iliad* VIII/133, XXI/198, *Odyssey* XXIV/539.

- 13 Homer, *Iliad* IX/236.
- 14 Homer, *Odyssey* V/128, VII/249, XII/415, XIV/305, XXIII/330.
- 15 Hesiod, *Theogony* 139ff.
- 16 Hesiod, *Theogony* 689ff.
- 17 See Hesiod *Theogony* 72, 286, 503, 707, 854.
- 18 Greene (1992) pp. 46 ff. has argued that this passage of the struggle of Zeus against Typhoeus describes a volcanic eruption, specifically that of Etna in 735 BCE. I am not convinced by this but even if Green were correct, the issue of aetiology still stands – Hesiod in line with the rest of the *Theogony* attributes the occurrence to the gods, Anaximander to natural causes.
- 19 Hesiod, *Theogony* 307.
- 20 Hesiod, *Theogony* 689ff.
- 21 Hesiod, *Works and Days* 53 for Zeus as cloud-gatherer and *Works and Days* 416 for Zeus as rain-bringer.
- 22 See e.g. Homer, *Iliad* XII/25 ff. where he rains continually to submerge a strategically important wall, Homer, *Iliad* XI/385ff. to punish unjust men.
- 23 See e.g. Homer, *Iliad* XV/3789ff. to aid the Achaeans in battle, Homer, *Iliad* XI/385ff. to punish unjust men, Homer, *Odyssey* IX/67ff. one of many storms at sea.
- 24 For winds in Hesiod see *Theogony* 253, 706 and the battle between Zeus and the Titans beginning at 821 and especially the comments on Typhoeus at 869. For winds in Homer, see e.g. the first part of Homer, *Odyssey* X.
- 25 The most significant is that Pseudo-Plutarch III, 3, 1 has the word *panta*, all, where Stobaeus I, 29, 1 does not, so line two is 'Anaximander all these come about because of wind' or 'Anaximander states that these come about because of wind'. Diels-Kranz (1952), Kahn (1960), KRS (1982) and Graham (2010) all print *panta*.
- 26 Hippolytus, *Refutation of All Heresies*, I, 6, 1–7, Aristotle, *Physics* III/4, 203b.
- 27 See Homer, *Iliad* II/246, *Odyssey* V/218. Cf. Naddaf (2005) p. 29.
- 28 Heraclitus Fr. 64.
- 29 Epicurus, *Letter to Pythocles*, 101–5.
- 30 Theophrastus also gives a long list of meteorological phenomena and explanations, unfortunately without names! He too treats all five of the Anaximander phenomena if we take winds in general as a substitute for Typhoons, four if we do not. Seneca deals extensively with meteorological issues in *Natural Questions*.
- 31 Aristotle, *Meteorologica* 369a10, II/9.
- 32 Lloyd (1991) p. 420.
- 33 This allusion to Hesiod theory is new and has considerable implications for the study of Anaximander more generally which I cannot follow up here, but I am writing a book on Anaximander.
- 34 Simplicius, *Physics* 24, 13. Simplicius, *Physics* 24, 21, goes on to say: 'It is clear that Anaximander, observing the change of the four elements into each other, thought it proper to make no one of these the substratum, but something else besides these. He produces coming to be not through alteration of the element, but through the separating off of opposites through the eternal motion.' Cf. Aristotle, *Physics* III/4 187a20, Pseudo-Plutarch, *Stromateis* 2.
- 35 I translate *apeiron* here as unlimited rather than infinite. This is philologically better, it is doubtful that Anaximander had a conception of the infinite as opposed to the unlimited, and unlimited allows the supposition that the *apeiron* may be qualitatively unlimited as well as spatially/temporally unlimited. See Kahn (1960) pp. 231ff.

- 36 Simplicius, *Physics* 24, 13.
- 37 See KRS (1983) pp. 105ff., 117ff.
- 38 Theognis 677–8, trans. Vlastos.
- 39 See here Mourelatos (1970) pp. 277ff.
- 40 I have argued elsewhere this is the proper translation. See Gregory (2009) pp. 45–7.
- 41 See Gregory (2009) pp. 47–8.
- 42 Aristotle, *Historia Animalium* 551b27–552b25, 569b for worms from water.
- 43 Barnes (1979) p. 23.
- 44 Barnes (1979) p. 22.
- 45 See Gregory (2007) Chs. 1–3.
- 46 Aristotle, *Physics* III/4, 203b7ff.
- 47 Cf. Matson (1953) p. 392.
- 48 See Aristotle *Physics* II/1 on nature and II/4ff. on chance.
- 49 Such issues were problematic in the Christianisation of Aristotle and featured in the various thirteenth-century condemnations of Aristotle.
- 50 The older debate on Anaximander, Burnet (1930) p. 13 arguing there was ‘no trace of theological speculation’ in Anaximander, supported by Matson (1953) while Jaeger (1947) p. 36 argued ‘theology, theogony and theodicy’ sat side by side in Anaximander’s account of nature, supported by Burch (1949–50) is conducted in terms of the old conflict model of the relation of science and religion. Anaximander sits much more easily in modern historiographies of science and religion.
- 51 See e.g. Gregory (2007) Ch. 2, Sedley (2007) Ch. 1.
- 52 Guthrie (1962) 88, n. 2, cf. LSJ give ‘steer’, ‘drive’, ‘guide, govern’, ‘act as pilot’.
- 53 Furley (1987) pp. 23–4.
- 54 Plato, *Philebus* 28d.
- 55 Plato, *Philebus* 30d.
- 56 Heraclitus Fr. 41, Fr. 64 though with a different verb.
- 57 Parmenides Fr. 12.
- 58 Hippocrates, *Regimen* I/10.
- 59 Diogenes of Apollonia Fr. 5.
- 60 Arguably it can also be found in the Derveni papyrus, again in relation to air, Col. 19, line 3–4.
- 61 West (1971) p. 77.
- 62 West (1971) p. 77. I would also disagree that Anaximander’s system is visionary rather than logical in its foundations, and even if Pythagoras heard Anaximander, I do not see that this is evidence of theological thinking in Anaximander.
- 63 Jaeger (1980) pp. 204ff.
- 64 It is possible to take the view that all of nature is part of god but that does not exhaust god.
- 65 This is not surprising as the ‘ideal’ view here was inspired by German nineteenth-century idealists such as Hegel and Schelling.
- 66 Hippolytus, *Refutation of all Heresies* I, 6, 5.
- 67 Kahn (1960) pp. 94–7.
- 68 Kahn (1960) p. 96.
- 69 Hahn (2001) pp. 73ff.
- 70 West (1971) p. 94ff. Cf. Couprie (2001).
- 71 Cicero, *De Divinatione* I, 50, 112.
- 72 Diogenes Laertius, *Lives of the Philosophers*, 2, 1–2: ‘He first discovered the sundial and set one up on the Sundials in Sparta.’

- 73 Thucydides 7.50.4. Trans. Jowett.
- 74 Herodotus VII, 37, 2. Trans. McCauley.
- 75 Vlastos (1975) p. 10ff.
- 76 See Pindar, 9th Paean.
- 77 Pseudo-Plutarch II, 25, 1.
- 78 Pseudo-Plutarch II, 29, 1.
- 79 Martin (2004) p. 15.
- 80 Martin (2004) pp. 15–16.
- 81 Martin (2004) p. 16.
- 82 It is of course a further question, beyond the scope of this book as to why Anaximander and other early Greek philosophers adopt parsimony and invariance.
- 83 Lloyd (1991) p. 423.
- 84 Lloyd (1991) p. 422.
- 85 Lloyd (1991) p. 423.
- 86 I do not subscribe to any philosophy of science or epistemology which treats all beliefs as acts of faith or anything similar. If anyone does subscribe to such a view, one might ask what their criticism of the presocratics is as opposed to anyone else?
- 87 Lloyd (1991) p. 423.
- 88 Cf. Graham (2006) p. 14ff.
- 89 One can criticise or defend Anaximander's theories in two ways, relative to modern standards or relative to Greeks standards. I believe they have epistemological merit either way.
- 90 Simplicius, *Physics* 24, 26. Cf. Aristotle, *Metaphysics* I/3 984a, Hippolytus *Refutation of all Heresies* 1, 7, 1.
- 91 Pseudo-Plutarch, *Stromateis* 3. The last line here probably attributes a view Anaximander did not hold – see KRS (1983) p. 152.
- 92 Hippolytus, *Refutation of all Heresies*, 1, 7, 5.
- 93 Plutarch, *De Prim. Frig.* 947f.
- 94 Stobaeus I, 29, 1.
- 95 Aristotle, *Meteorology* II/9, 370a12ff.
- 96 Aristotle, *Meteorology* II/7, 365b7ff.
- 97 See Hesiod, *Theogony* 15, *Works and Days* 667.
- 98 Stobaeus 1, 31, 1, Pseudo-Plutarch III, 4.
- 99 Seneca, *Natural Questions*, II/17.
- 100 See e.g. Homer, *Iliad* XI/26 ff., XVII 547ff.
- 101 Pseudo-Plutarch III, 5.
- 102 Stobaeus I, 10, 12, cf. Pseudo-Plutarch I, 3, 4.
- 103 *cosmos* need not have the precise technical sense it had later, and while *pneuma* may look like a typical Stoic accretion, the term was in use at this stage.
- 104 KRS (1983) p. 159ff.
- 105 KRS (1983) p. 159.
- 106 An interesting idea here might be that just as air/soul holds us together over time and individuates humans, so air/soul holds the *cosmos* together over time and individuates it from its surrounds.
- 107 For further discussion here see Gregory (2007) Ch. 2 and KRS (1983).
- 108 Aristotle, *Physics* III, 203b7ff.
- 109 Simplicius *Physics* 24, 26, reporting Theophrastus, cf. Hippolytus, *Refutation of all Heresies*, 1, 7, 5.

- 110 Diogenes Laertius IX, 57. Diogenes of Apollonia's dates would indicate he was a follower rather than a direct pupil of Anaximenes, as Laertius has it.
- 111 Diogenes of Apollonia Fr. 5.
- 112 It is interesting that the Derveni papyrus, Col. 19 line also has a *kratein* cognate in relation to the dominance of air, in this case *epikratein*.
- 113 Stobaeus I, 1, 29b. Cf. Cicero, *De Natura Deorum* 1, 10, 26: 'Anaximenes said that air is a god, that it is generated, is measureless, is infinite and is always in motion.'
- 114 Augustine, *The City of God* VIII, 2.
- 115 Guthrie II, p. 363.
- 116 Simplicius, *Physics* 25, 1.
- 117 Diogenes of Apollonia, Fr. 3. Cf. Simplicius, *Physics* 151, 24: 'He demonstrates at great length that there is much intelligence in the *archê* he hypothesises.'
- 118 Diogenes of Apollonia Fr. 5.
- 119 Aristotle, *Metaphysics* I/3, 983b7ff.
- 120 Aristotle, *Metaphysics* I/3, 983b21ff. Cf. Simplicius *Physics* 23, 21ff. who gives Theophrastus' similar account of Thales.
- 121 Pseudo-Plutarch I/25, Stobaeus 1,4, 7a.
- 122 Simplicius, *Physics* 23, 29.
- 123 Aristotle, *On the Heavens* II/13, 294a28ff.
- 124 Seneca, *Natural Questions* III, 14.
- 125 Pseudo-Plutarch III, 15.
- 126 Pseudo-Plutarch IV, 1, 1.
- 127 Heraclitus Homericus, *Quaest. Hom.* 22.
- 128 Aristotle, *On the Heavens* 294a29ff.
- 129 Cf. O'Grady (2002) pp. 71ff., KRS p. 92ff.
- 130 Heidel (1942) p. 5.
- 131 Tablet V is somewhat shorter at 22 lines.
- 132 This translation is that of Heidel (1942) p. 8.
- 133 This is an excerpt from the 40 lines of Eridu:

All the lands were sea
 The spring which is in the sea was a water pipe
 Then Eridu was made, Esaglia built
 Esaglia, whose foundations Lugaldukuga laid within the Apsu
 Babylon was made, Esaglia was completed
 The Anunnaki gods he created at one time
 The holy city, the dwelling of their heart's delight, they called it solemnly.
 Marduk constructed a reed frame on the face of the waters
 He created dirt and poured it out by the reed frame
 In order to settle the gods in the dwelling of their heart's delight
 He created mankind

- 134 *The Creation of Atum*, version 1, following J. A. Wilson's translation.
- 135 Athenagoras, *Pro Christianis* 18.
- 136 I follow KRS here in omitting line 118, which is in some medieval MSS but not in many ancient quotations. See KRS p. 35, n. 1.
- 137 Hesiod, *Theogony*, 116–33.
- 138 Aristotle, *Metaphysics* I/3, 983b22ff.
- 139 Heraclitus Homericus, *Quaest. Hom.* 22.
- 140 O'Grady (2002) pp. 64–5.

- 141 Aristotle, *On Animals* I/2, 405a19.
- 142 Diogenes Laertius I, 24.
- 143 Aristotle, *On Animals* I/2, 411a7, cf. contra KRS (1983) p. 95, amber when rubbed produces static electricity, not a magnetic field. The earliest differentiation between electrostatic and magnetic effects though was not until the sixteenth century, with William Gilbert's *De Magnete*.
- 144 Stobaeus 1, 1, 29b.
- 145 Stobaeus 1, 1, 29a.
- 146 Cicero, *On the Nature of the Gods* 1, 10, 25.
- 147 Cf. Collins (2008) p. 28.
- 148 See Plato, *Laws* 899b.
- 149 KRS p. 97.
- 150 Plato, *Laws* 899b.
- 151 Cf. O'Grady (2002) pp. 108ff.
- 152 Betegh (2006) p. 677.

Chapter Four

- 1 Lloyd (1970) p. 50, (1978) p. 9, (1983).
- 2 I have nothing to add to this debate here. The two works I shall look at are accepted as Hippocratic and that is all that concerns me in this context.
- 3 See Gomperz (1922). See van der Eijk (2011) for opinions on why this view has persisted in Greek medicine.
- 4 See Edelstein (1987).
- 5 Latinised title of *On the Sacred Disease*.
- 6 Miller (1953) p. 1, Porter (1999) p. 53. Cf. Longrigg (1993) p. 1: 'It was the Greeks who first evolved rational systems of medicine for the most part free from magical and religious elements and based on natural causes'; Longrigg (1993) p. 8, cf. p. 26: 'The Hippocratic author ... rejects superstitious and supernatural causation and gives an entirely natural explanation of the disease.'
- 7 Porter (1999) p. 53.
- 8 Edelstein (1987) p. 214.
- 9 Fowler (1995) pp. 5–6.
- 10 Temkin (1971) p. 3: 'Showing both physical and psychical symptoms, epilepsy more than any other disease was open to interpretation both as a physiological process and as the effect of spiritual influences.'
- 11 I take the conventional view that diseases for Hesiod, while they might be argued to have their own nature, are ultimately god-sent and very different in nature to diseases in the Hippocratic corpus. See Lloyd (1987) p. 17, n. 52.
- 12 As we shall see later in this book, like some other presocratic philosophers as well.
- 13 The modern word epilepsy is derived from the Greek *epilambanein*, to take hold of or seize. In *On the Sacred Disease* *epilambanein* is used only once for epilepsy, otherwise it is referred to as the sacred disease.
- 14 Wilson and Reynolds (1990) p. 186.
- 15 Tablet BM 47753, 25th or 26th tablet in a series known as *Sakikiu*, 'all diseases'. Middle first millenium BCE, trans. Wilson and Reynolds (1990).

- 16 Tablet BM 47753, trans. Wilson and Reynolds (1990).
- 17 Tablet BM 47753, trans. Wilson and Reynolds (1990).
- 18 See e.g. Longrigg (1993) p. 6ff. for more on pre-Greek medicine.
- 19 Homer, *Iliad*, I, trans. W. Leaf, A. Lang, E. Myers.
- 20 Cf. Homer, *Odyssey* V, 394ff, *Odyssey* XI, 409ff. Lloyd (2003) p. 16: 'Within the framework of the epic it is assumed that the god causes the plague – and can bring about its end – and in both cases he does so on the request of his priest, and for a reason.'
- 21 It is worth noting that Homer does not develop a comprehensive theory of disease (there is no sense that all diseases come from the gods) nor is there is a sense of disease being inflicted due to some injustice (see Lloyd (2003) pp. 16–17). That is perhaps not surprising as that is not Homer's aim, but it is worth contrasting with later developments.
- 22 Hesiod, *Theogony*, 238ff., trans. West. A more famous passage in Hesiod would be *Works and Days* 85ff., the tale of Pandora's box carrying diseases, sent by Zeus as a punishment. For more on Homer and Hesiod, see Longrigg (1993) p. 8ff.
- 23 Cf. Mark 9.14, New King James Version: '17 Then one of the crowd answered and said, "Teacher, I brought You my son, who has a mute spirit. 18 And wherever it seizes him, it throws him down; he foams at the mouth, gnashes his teeth, and becomes rigid. So I spoke to Your disciples, that they should cast it out, but they could not." 19 He answered him and said, "O faithless generation, how long shall I be with you? How long shall I bear with you? Bring him to Me." 20 Then they brought him to Him. And when he saw Him, immediately the spirit convulsed him, and he fell on the ground and wallowed, foaming at the mouth. 21 So He asked his father, "How long has this been happening to him?" And he said, "From childhood. 22 And often he has thrown him both into the fire and into the water to destroy him. But if You can do anything, have compassion on us and help us." 23 Jesus said to him, "If you can believe, all things are possible to him who believes." 24 Immediately the father of the child cried out and said with tears, "Lord, I believe; help my unbelief!" 25 When Jesus saw that the people came running together, He rebuked the unclean spirit, saying to it: "Deaf and dumb spirit, I command you, come out of him and enter him no more!" 26 Then the spirit cried out, convulsed him greatly, and came out of him.'
- 24 Hippocratic author, *On the Sacred Disease* II, 1–4.
- 25 Cf. Plato, *Republic* 364bff., *Laws* 909aff. on itinerant charm and incantation sellers.
- 26 See Hippocratic author, *On the Nature of Man* 9, 14 and 9, 44ff., *On Winds* 6, 19, cf. *Epidemics* 6, 7.
- 27 Hippocratic author, *On the Sacred Disease* I, 1–3, cf. V 1–4.
- 28 See Hippocratic author, *On Airs, Waters and Places* III/20, IV/30 and Ch. XXII, *On Breaths* XIV.
- 29 Hippocratic author, *On the Sacred Disease* XVI, 43–6.
- 30 Hippocratic author, *On the Sacred Disease* XIV, 11–19.
- 31 See Lloyd (1979) pp. 23–4.
- 32 Nothing can be certain here, though if this is a thought experiment 'foul smelling' does seem otiose. The Anaxagoras tale may be a multiplying of tales rather than a parallel instance! This is not to take a position on experiment/observation in the Hippocratic corpus in general, or to suggest that this experiment is in any way modern, merely that this particular experiment actually took place.
- 33 Hippocratic author, *On the Sacred Disease* XVI, 42–6.
- 34 Hippocratic author, *On the Sacred Disease* XXI, 1–26.

- 35 Lloyd (1979) pp. 19ff.
- 36 Hippocratic author, *On the Sacred Disease* IV, 10–16, Cf. *On the Sacred Disease* IV, 1–4: 'For is they can bring down the moon, to eclipse the sun, make storm and good weather, rain and drought, the sea impassable and the earth barren, and all the other such things.'
- 37 I was very tempted here to translate using a modern colloquialism 'these men, needing a life' but that may be a touch too pejorative!
- 38 Hippocratic author, *On the Sacred Disease* IV, 16–21.
- 39 Hippocratic author, *On the Sacred Disease* IV, 21–35.
- 40 See Homer, *Odyssey* XIX, 455ff. for healing songs.
- 41 See Hankinson (1998) pp. 6–7 on this. As Hankinson comments, we cannot take silence as proof.
- 42 Hippocratic author, *On the Sacred Disease* XXI, 4–7.
- 43 Van der Eijk (1991) p. 88.
- 44 There are of course different views here on the relation of the divine and nature in *On the Sacred Disease*. Edelstein (1987) p. 216: 'The two spheres of the divine and the natural are then fundamentally separate, although their influence is combined in every action.' Jouanna (1999) p. 191: 'The concept of the divine is emptied of all traditional anthropomorphic representation and defined instead by its accordance with the natural.'
- 45 Hankinson (1998) p. 11.
- 46 Hankinson (1998) p. 12. Hankinson continues in parentheses: Although it is another question whether the Hippocratics could have realized this, and hence that any such talk of the divine was mere linguistic window-dressing.
- 47 Hankinson (1998) p. 13.
- 48 So too it will be possible to tie in similar themes from Heraclitus. Miller (1953) is keen on an association between Diogenes' view of air as intelligent and the Hippocratic corpus, though I am not myself convinced.
- 49 See here the classic accounts of Vlastos (1975) pp. 3ff., Kahn (1960) pp. 219ff.
- 50 See Mikalson (2010) p. 56.
- 51 Martin (2004) p. 42
- 52 MS = *De Morbo Sacro* = *On the Sacred Disease*
- 53 Van der Eijk (1991) p. 89., cf. Van der Eijk (2008) pp. 392–3, Ducatillon (1977) pp. 159–79.
- 54 Ducatillon (1977), van der Eijk (1991a).
- 55 I would broadly agree with van der Eijk (1991) p. 96 that 'It is unnecessary or even undesirable to strive to harmonize the doctrines of the various treatises in this heterogeneous collection, and it is dangerous to use the theological doctrine of one treatise (e.g. the supposedly divine character of climatic factors in MS) as evidence in favour of an interpretation of the word *theios* in another treatise.'
- 56 See here van der Eijk (1991) pp. 93ff.
- 57 Although I ultimately take a different line from van der Eijk here, I think he is quite correct to subject these two views to a tight analysis and to point out that both have problems in accounting for all that the author has to say, the first alternative more so than the latter.
- 58 See van der Eijk (1991) p. 95, n. 17.
- 59 See Lloyd (1983) p. 13.
- 60 Van der Eijk (1991) p. 110.
- 61 Van der Eijk (1991) p. 110. *On the Sacred Disease* IV.
- 62 Van der Eijk (1991) p. 110.

- 63 This seems a much more plausible position than the 'supreme divine power' view mentioned earlier.
- 64 Van der Eijk (1991) p. 112.
- 65 Miller (1953) p. 2, n. 3.
- 66 Hippocratic author, *On Airs, Waters and Places* XXII, 8–14.
- 67 Hippocratic author, *On the Art* VI, 14–18.
- 68 LSJ give 'at random, without reason' for *matên*.
- 69 Leucippus, Fr. 2. Cf. Cicero, *On Fate* 10, 23 and 17, 39.
- 70 Though Jouanna (1999) pp. 254–5 says that: 'One of the greatest virtues of the physicians of the Hippocratic Collection is to have stated, in its most universal form, what was later to be called the principle of determinism. All that occurs has a cause. It is in the treatise of *The Art* that the most theoretical statement of this principle is to be found: "Indeed, under a close examination spontaneity disappears; for everything that occurs will be found to do so through something [*dia ti*]."'
- 71 Hippocratic author, *On Prognosis* 1, 19–22, trans. Hankinson.
- 72 See Hankinson (1998) p. 18. The clause is in all the known manuscripts.
- 73 See Hankinson (1998) pp. 18–19 for further discussion.
- 74 Hippocratic author, *Nature of Women* VII/1, trans. Hankinson.
- 75 See Hankinson (1998) pp. 21–2 for some more elaborate theories.
- 76 Hippocratic author, *On Airs, Waters and Places* X, trans. Adams.
- 77 Hippocratic author, *On Airs, Waters and Places* XI, trans. Adams. Cf. *On Regimen* 1/2: 'A man must watch the rising and the setting of the stars, so that he knows how to guard against changes and excesses of food, drink, winds, indeed the whole cosmos, from which arise diseases for men.'
- 78 It might be possible to construe the references to gods as a rather loose pantheism. I have not tried to do so as a critical part of *On Decorum* VI is textually very poor and it is very hard to make much sense of it.
- 79 Jouanna (1999) p. 213.
- 80 See Hesiod, *Works and Days*, 225–47.
- 81 Hesiod, *Works and Days*, 239–44.
- 82 Jouanna (1999) p. 213.
- 83 Jouanna (1999) p. 237ff.
- 84 Hippocratic author, *On Ancient Medicine* XIV.
- 85 Homer, *Iliad* IV, 218ff. It is perhaps also worth considering how the muses inform Hesiod for his account.
- 86 *On Airs, Waters and Places* Ch. 3, see Longrigg (1993) p. 38.
- 87 Van der Eijk (2011) p. 30. Cf. Lloyd (1987) pp. 22–4.
- 88 As van der Eijk notes, the author never uses *psuchê*, soul and all mental functions are rooted in the brain.
- 89 Van der Eijk (2011) p. 32.
- 90 Homer, *Iliad* XIX, 86ff., see Dodds (1951) pp. 2–3.
- 91 Hippocratic author, *On Airs, Waters and Places* II.
- 92 Hippocratic author, *On Airs, Waters and Places* VIII.

Chapter Five

- 1 *On the Sacred Disease* and *On Regimen* are the standard battlegrounds for the issue of the supernatural in the Hippocratics. See e.g. Edelstein (1987), Hankinson (1998).
- 2 Lloyd (1979) p. 158 considers this arrangement to be 'bizarre', Hankinson (1998) p. 31 n. 56 considers it 'rationalist' but 'exotic and bizarre'.
- 3 The term *diacosmeō* is interestingly strong, suggesting a thorough ordering. LSJ give 'to divide and marshal, muster, array' with usages drawn from Homer and Thucydides. Cf. Mourelatos (1970) p. 230 on a similar use in Parmenides.
- 4 Hippocratic author, *On Regimen* I/10.
- 5 Also used later The stars are in the outer orbit, the sun in the middle, the moon nearest the hold. Hippocratic author, *On Regimen* IV/89.
- 6 See Aristotle, *Physics* VIII/2, 252b24–7 and *On Generation and Corruption* II, 10.
- 7 See e.g. Plato, *Timaeus* 47aff., 81ab, 88de.
- 8 There was also neoplatonic speculation on the circulation of the blood prior to Harvey by Giordano Bruno and support for the macrocosm/microcosm idea of blood circulation in thinkers after Harvey such as Highmore and Sachs a Lowenheimb.
- 9 There are other influences from presocratic philosophers too, but that from Heraclitus seems most marked and most important for my argument.
- 10 Heraclitus Fr. 30.
- 11 Heraclitus Fr. 64.
- 12 Hippocratic author, *On Regimen* I/10.
- 13 Heraclitus Fr. 41.
- 14 Hippocratic author, *On Regimen* I/10.
- 15 Heraclitus, Fr. 61.
- 16 One might also look at the opening of the Hippocratic *On Fleshes* here: 'In my view, what we call heat is immortal and knows all things, it hears and sees and knows all the things that are and all that will be.' *On Fleshes* gives natural explanations for the origins of all the parts of the body.
- 17 See Hippocratic author, *On Fleshes* II/8 for active fire and cosmogony.
- 18 Aristotle, *Physics* III/4, 203b7ff.: 'The unlimited has no *archê* ... However, this seems to be the *archê* of all other things, and it surrounds and steers (*kubernan*) all, as with all those who do not suppose other explanations, such as mind or love, beyond the unlimited. This is divine, for it is immortal and indestructible; as Anaximander and most of the physiologoi say.'
- 19 At Parmenides Fr. 12 a goddess steers the cosmos, in Diogenes of Apollonia Fr. 5 air performs the steering role, Plato at *Politicus* 272e has god as the helmsman of the cosmos and Aristotle at *Meteorology* I/2 has events in the terrestrial realm being steered by the motions in the celestial realm.
- 20 Plato, *Philebus* 28d: 'Should we say that the whole universe is ruled by unreason, irregularity and chance, or on the contrary, as some of those who came before us said, say that *nous* and a marvellous organising intelligence steer (*diakubernan*) it.' Cf. Plato, *Philebus* 30d.
- 21 Stobaeus I, 10, 12 (=Aetius I, 3, 4, DK13B2), cf. Pseudo-Plutarch I, 3, 4: 'Anaximenes declared air to be the *archê* of existing things. From it all things come to be and into it all things are dissolved. He says as our soul, being air, holds us in order (*sungratei*), so wind and air envelop the whole *kosmos*.'

- 22 For cognates of *kratein* (*songkratein*, *epikratein*) see Anaximenes (Stobaeus I, 10, 12 (=Aetius I, 3, 4, DK13B2), cf. Pseudo-Plutarch I, 3, 4.), Diogenes of Apollonia Fr. 5 (*kubernao*, *kratein* etc.), Derveni papyrus, Col. 19 (*epikratein*), all in relation to the role of air.
- 23 See e.g. Hippocratic author, *On Regimen* I/2, I/28, II/39, II/61, II/62, II/66, IV/89, IV/93.
- 24 Hippocratic author, *On Regimen* I/9, 17–20.
- 25 Another, as Freudentahl has argued, is that the Hippocratic notion of health as an equilibrium may derive from the way that Anaximander treats the opposites emerging from the *apeiron*. See Freudentahl (1986).
- 26 One might also look at the opening of Hippocratic author, *On Fleshes*, where they wish to discuss the heavens in so far as they are important in accounting for the origins of humans. This must be balanced though with a certain hostility to philosophy in some Hippocratic works such as *On the Nature of Man* and *On Ancient Medicine*, though the critique there is a question of how practically experienced in medicine some theoreticians are.
- 27 Cf. Longrigg (1993) p. 1, cf. p. 26: ‘The emancipation of medicine from superstition was the outcome of precisely the same attitude of mind which the Milesian natural philosophers had been the first to apply to the world about them.’
- 28 One can also add the point made by Jaeger and supported by Longrigg (1993) pp. 32–3, that the Hippocratics wrote in the Ionian dialect even though they were writing outside Ionia.
- 29 Hankinson (1998) p. 11.
- 30 Here I would agree with Jaeger (1947) p. 158, that we can only understand the Hippocratic conception of the divine against ‘The profoundly altered conception of the nature of the Divine for which philosophy had been preparing the way for a hundred years.’
- 31 It is worth noting here that *On Regimen* I/10 has a single cosmos ordered by steering fire. The author feels no need of multiple cosmoi. See Gregory (2007) on single and multiple cosmoi theories in antiquity.
- 32 Hippocratic author, *On Regimen* I/12.
- 33 Hippocratic author, *Prognostic* I, trans. Adams.
- 34 Hippocratic author, *On Regimen in Acute Diseases* III, trans. Adams. The diviner in Homer, *Iliad* I/62 is a watcher of birds.
- 35 Hippocratic author, *On Regimen* I/11.
- 36 A parallel here for nature as the mind of god, or even gods, as both the world soul and the demigod planets are involved, is Plato in the *Timaeus*, where the motions of the heavens are the visible manifestations of the motions of the mind of the world soul. An important further parallel is that just as everything happens *kata phusin* (I/10), in the *Timaeus* we can have calculations about the heavens which are entirely correct according to nature (*logismôn kata phusin orthotêtos*, *Timaeus* 47c2).
- 37 Homer, *Iliad* I/62, I/106, I/384, *Odyssey* X/493, XII/267, XV/252, XVII/384.
- 38 Homer, *Iliad* I/62, I/106, I/384.
- 39 Homer, *Iliad* I/62, I/106, I/384, *Odyssey* XVII/ 384.
- 40 Hesiod, *Theogony* 25ff.
- 41 Hesiod, *Theogony* 31–2.
- 42 See Dodds (1951) p. 181.
- 43 Hippocratic author, *On Regimen* I/15.
- 44 It is possible that the steering function of nature is implicated here in nature being able to accomplish healing. That might be argued from the general context (after *On*

Regimen I/10) or from the ‘Nature herself knows how to accomplish these things’ comment here, the verb of knowing being significant. If so, here we have another explanatory use for the steering function. Can the healing we see in nature be explained without supposing this sort of steering on nature’s part?

- 45 See Holowchak (2002) for an interesting comparison of *On Regimen* IV with some later sources on the medical diagnosis of dreams.
- 46 See Hankinson (1998).
- 47 Hankinson (1998) p. 28.
- 48 Homer, *Iliad* I/62. See also my Ch. 9 for Leucippus and Democritus on dreams in relation to Homer.
- 49 Homer, *Iliad* II/6ff.
- 50 Homer *Iliad* I/63, II/6ff., II/80, *Odyssey* XIV/481ff., XX/87. In Hesiod *Theogony* 212, Dreams is one of the children of Night.
- 51 Homer, *Odyssey* XIX/535ff.
- 52 Hippocratic author, *On Regimen* IV/81.
- 53 Omitting *prepon kai liên estin* with Jones (1931).
- 54 Hippocratic author, *On Regimen* IV/87.
- 55 One parallel here would be Empedocles, Strasbourg Papyrus, Ensemble d, 11: ‘When there chanced to be an unyielding flame.’ The Greek translated here as ‘chanced to be’ is *sunetungchane*, another would be Diogenes Laertius, *Lives of the Philosophers* 2, 1–2, where in relation to Anaximander he tells us that: ‘He made a summary exposition of his own views, which Apollodorus of Athens somehow chanced across (*perietuchen*).’
- 56 As Hankinson (1998) and Jones (1931) do.
- 57 One might compare here Hippocratic author *On the Places in Man* 46, 342 on doctors not waiting for chance, but being able to be successful with or without chance.
- 58 Hippocratic author, *On Regimen* IV/87.
- 59 Here I disagree with van der Eijk (2008) p. 394, who believes that the author does not question the ability of the interpreters.
- 60 Another reading is that this is a demarcation dispute – this sort of dream is for dream interpreters, while this sort of dream is for doctors to interpret. See Nutton (2004) pp. 65–6. This might accept some dreams as divine, or might be agnostic on their provenance.
- 61 Hippocratic author, *On Regimen* IV/88. One manuscript here has ‘Hippocrates on Dreams’ following this phrase, which would make the transition even more emphatic. Either that is in the original, or one of the editors saw the emphasis and glossed.
- 62 Hippocratic author, *On Divination by way of Dreams* II, trans. Beare.
- 63 See Hankinson (1998) p. 29.
- 64 See Hippocratic author, *On Regimen in Acute Diseases* VIII, 3–15.
- 65 Hippocratic author, *On Regimen* I/12.
- 66 Cf. Hankinson (1998) p. 29.
- 67 Cf. Hankinson (1998) p. 33.
- 68 Hippocratic author, *On Regimen* IV/CII.
- 69 One advantage of this reading is that it gives a natural interpretation without having to resort to the idea that the author is in some sense forced to pay lip service to orthodox religion. Cf. van der Eijk (2008) p. 395. I broadly agree with Lloyd (1979) pp. 12–13 that if we look at the religious criticism put forward by Xenophanes and Heraclitus it seems quite possible to put forward new religious ideas in this period.

- 70 Hippocratic author, *Prorrhetic* II, 2, trans. Hankinson.
- 71 Hippocratic author, *On Regimen* IV/89.
- 72 Hankinson (1998) p. 30.
- 73 Kierkegaard.
- 74 See Heiler (1932). The full typology is Secular Spirituality – Primitive Prayer – Ritual Prayer – Greek Cultural Prayer – Philosophical Prayer – Mystical Prayer – Prophetic Prayer.
- 75 Xenophanes Fr. 1, 15–16.
- 76 Hippocratic author, *On Regimen* IV/87.
- 77 Though cf. Hankinson (1998) p. 33, n. 57.
- 78 As we saw in the introduction to this book, later in antiquity Soranus used amulets to improve the emotional states of his patients while holding a naturalistic view.
- 79 Aristotle, *Nicomachean Ethics* V/1, 1129 b3.
- 80 Philodemus, *On Piety*, 740–50, trans. Obbink.
- 81 Cleanthes, SVF, 1.527.
- 82 Xenophanes Fr. 1, 15–16.
- 83 Plutarch, *On the Cessation of Oracles*, 17, 419a, cf. Democritus Fr. 37 and Fr. 112.
- 84 Homer, *Iliad* I/41–1, trans. Pulleyn.
- 85 Homer, *Iliad* VIII/248–50, trans. Pulleyn.
- 86 In particular from Xenophanes Fr. 1, see my discussion in Ch. 6.
- 87 Hippocratic author, *On Regimen* IV/89.
- 88 Here I disagree with Dodds (1951) p. 119 that these dreams are symbolic. I can see why Dodds, with some of the Freudian themes of his book, would like to see the dreams as symbolic but I see no necessity to take them in that way.
- 89 In comments on Hankinson's paper, Hankinson (1998) p. 31 n. 56.
- 90 In comments on Hankinson's paper, Hankinson (1998) p. 31 n. 56.
- 91 As discussed in the Plato and Aristotle chapter, a relation of sympathy between macrocosm and microcosm is not non-natural and there are considerable similarities between some versions of sympathy and the Newtonian idea of gravity as action at a distance.
- 92 Hankinson (1998) p. 31, n. 56.
- 93 In comments on Hankinson's paper, Hankinson (1998) p. 31 n. 56.
- 94 Hippocratic author, *On Regimen* I/10.
- 95 Hankinson (1998) p. 11.
- 96 Lloyd (1979) pp. 22–3, (1987) pp. 27–8, (2003) p. 47. See Longrigg (1993) p. 5 for a more positive view.
- 97 Martin (2004) p. 50, Martin's emphases.
- 98 Given the affinity in some respects to early presocratic philosophy and the way that the Hippocratics stress invariance in relation to the aetiology of disease, one might also argue that certainly invariance and possibly parsimony as well are drivers in their rejection of the non-natural.
- 99 The pantheism view seems more generous to the Hippocratics than the view Edelstein (1987) p. 214 attributes to them. He accuses them of self-contradiction, as he says for the Hippocratics 'Everything is natural, but in being so it is divine too, or to use another phrase it is supernatural.' The question then is whether something can be divine without being supernatural, to which my reply is yes it can, especially for a pantheist.
- 100 There is something of a fault line between *On Regimen* I–III and *On Regimen* IV but *On Regimen* IV is generally considered to be Hippocratic.

- 101 See Lloyd (2003) p. 40ff.
- 102 Pseudo-Plutarch V, 30, 1.
- 103 Vlastos (1945) p. 581, n. 22.
- 104 See van der Eijk (2008) p. 393. The drive has come both from theoretical work on the historical relations between science and religion, and from studies of the ancient world.

Chapter Six

- 1 So too would Parmenides, Zeno and Melissus.
- 2 As noted in the introduction, I make no claim to be comprehensive on the presocratics in this book (that would require more than one book) so I try to deal with the most interesting and important examples.
- 3 See recent work by Mourelatos (2008), Leshner (1978 and 1992) and Curd (2004).
- 4 KRS p. 168.
- 5 Xenophanes, Fr. 11, cf. Fr. 12.
- 6 Xenophanes, Fr. 14.
- 7 Xenophanes, Fr. 16.
- 8 Xenophanes, Fr. 15.
- 9 See Sextus Empiricus I/289, see also Homer *Iliad* XIV/204ff.
- 10 See Homer, *Iliad* XIII/355 ff., XIV/302 ff. Births of gods also figure in Hesiod's *Works and Days*.
- 11 Xenophanes Fr. 1, 21–3.
- 12 Xenophanes Fr. 29.
- 13 Xenophanes Fr. 33.
- 14 Xenophanes Fr. 27.
- 15 Hippolytus, *Refutation of all Heresies* I, 14, 3, Achilles, *Isagoge* 4, 34, 11, 'We see the upper limit of the earth by our feet, in contact with the air, but below its reach is unlimited.' Pseudo-Plutarch II, 24, 9 tells us that: 'Xenophanes says that there are many suns and moons according to the regions, divisions and belts of the earth.'
- 16 Pseudo-Plutarch II, 13, 4, cf. Pseudo-Plutarch II, 25, 4.
- 17 Hippolytus, *Refutation of all Heresies* I, 14, 5.
- 18 Pseudo-Plutarch II, 4, 11.
- 19 Electrical fields are more concentrated around sharp points so discharge is more likely to happen here.
- 20 Melville, *Moby Dick*, Ch. 119. St. Elmo's fire has been seen as a positive omen (guardian spirits are here to help us in a storm) or a negative omen, especially as the electrical fields which cause St. Elmo's fire can interfere with compasses.
- 21 Here I am following Mourelatos (2008) pp. 134–5. The belief that this phenomenon was non-natural was long-lasting – sailors referred to instances of St. Elmo's fire as 'spirit-candles'. Putting 'St. Elmo's Fire' into Google image search will bring up several depictions of St. Elmo's fire at sea, often with sailors looking amazed. St. Elmo's fire can also occur on land and will again be most likely where there are pointed objects – occasionally it will occur on livestock with pointed horns!
- 22 Xenophanes Fr. 39.
- 23 It had been thought to be Roman, but new material has come to light. See Mourelatos (2008) p. 135 and p. 160, nn. 12 and 13.

- 24 Mourelatos (2008).
- 25 Homer, *Iliad* passim and *Odyssey* passim.
- 26 Xenophanes Fr. 10.
- 27 Xenophanes Fr. 18.
- 28 Stobaeus I, 29, 1.
- 29 See Pseudo-Plutarch III, 5.
- 30 In both Homer and Hesiod Iris is goddess of the rainbow and messenger of the gods. In Homer, Zeus uses the rainbow as a portent for humans, e.g. Homer, *Iliad* XI/26ff., XVII 547ff.
- 31 Xenophanes Fr. 32.
- 32 Dodds (1951) pp. 180–1.
- 33 Cicero, *On Divination*, I/5.
- 34 Leshner (1992) p. 143.
- 35 Lloyd (1991) p. 420.
- 36 Lloyd (1991) p. 420.
- 37 Lloyd (1991) p. 420.
- 38 Agreeing with Leshner (1992) on the text here as other versions are unintelligible.
- 39 Xenophanes Fr. 30.
- 40 Mourelatos (2008) pp. 136–7. See also Leshner (1992) p. 139.
- 41 Xenophanes Fr. 31.
- 42 See Homer, *Iliad* VIII/480, XIX/398, *Odyssey* I/8, I/24, XII/176, 263, 346, 374.
- 43 See Hesiod, *Theogony* 374 and 1011.
- 44 Aetius II, 30, 8.
- 45 Mourelatos (2008) pp. 136–7.
- 46 Cicero, *On Divination* I, 3, 5.
- 47 Pseudo-Plutarch, 5, 1, 1.
- 48 Xenophanes Fr. 7.
- 49 See Leshner (1992) pp. 79–80.
- 50 Leshner (1992) pp. 80–1.
- 51 Xenophanes Fr. 23.
- 52 Cf. KRS p. 170, Barnes (1979) pp. 89–92.
- 53 Xenophanes Fr. 1.
- 54 Leshner (1992) p. 98.
- 55 Stokes (1971) p. 76.
- 56 So this prayer, in modern jargon, and losing the Christian context, is ecumenical.
- 57 This is not to deny that fragment 1 has an ‘uplifting’ structure – floor to table to house to humans to god – but to suggest it has a spiritual sense of generosity as well.
- 58 His show was intermittently banned in Ireland. Allen was brought up in Ireland as a Catholic.
- 59 An outside possibility – this is a meeting of monotheists, but monotheists with different conceptions of god. ‘Gods’ then refers to a multiplicity of monotheist conceptions of god and not to polytheism. Holding gods in high regard might then mean something like ‘I respect your monotheism even if it is different from my monotheism’.
- 60 See e.g. Plato, *Republic* 378e–383e.
- 61 Aristotle, *Metaphysics* I, 986b 21–5. Trans. Trepanier. Cf. Plato, *Sophist* 242d, where Xenophanes is given the position that ‘all things are one’.
- 62 See Xenophanes Fr. 28.
- 63 Xenophanes Fr. 25.

- 64 Xenophanes Fr. 26.
- 65 See Homer, *Iliad* I/530, VIII/443.
- 66 LSJ give 'of a bell, to be set in vibration, Phlp. in de An.355.23.' In many ways it would be nice to take *kradainai* as equivalent to *kubernein* in Anaximander, etc., as Guthrie and Cornford do, but this does not seem compatible: see Lesher (1992) p. 107.
- 67 I would agree with KRS p. 172 that: 'Xenophanes' god was conceived as a negation of Homeric divine properties.'
- 68 Trepanier (2010) p. 280.
- 69 Xenophanes Fr. 1, 15–16.
- 70 Frankel (1975) pp. 327ff., Marcovitch (1978) pp. 7ff., Meijer (1981) pp. 222ff.
- 71 Xenophanes Fr. 1, 14–15.
- 72 Guthrie (1962) p. 393.
- 73 Mourelatos (2008), Lesher (1992) pp. 145ff.
- 74 Lloyd (1991) p. 420.
- 75 Mourelatos (2008).
- 76 Mourelatos (2008) pp. 158–9.
- 77 The modern view is somewhat different to the ancient view, where Heraclitus was assimilated to the Stoic theory of ekpyrosis. See Gregory (2007).
- 78 Taking *ton auton hapantôn* as genuine with Guthrie, Vlastos and Kahn but against Kirk and KRS.
- 79 Heraclitus Fr. 30.
- 80 Kirk (1962) p. 311. There are similar polar expressions prior to Heraclitus; Homer, *Iliad* VIII/27, XIV/342, Xenophanes Fr. 23.
- 81 Heraclitus Fr. 90.
- 82 Theognis 677–8, Simplicius, *Physics* 24, 13, for the Anaximander fragment.
- 83 Heraclitus Fr. 1. Cf. Fr. 2: 'Though the logos is common, the many live as if they had a wisdom of their own.'
- 84 Heraclitus Fr. 89, cf. Fr. 21.
- 85 Dodds (1951) p. 181.
- 86 Heraclitus Fr. 64.
- 87 Heraclitus Fr. 41.
- 88 Heraclitus Fr. 31.
- 89 Stobaeus 1, 29, 1.
- 90 Heraclitus Fr. 14, cf. Fr. 15.
- 91 Heraclitus Fr. 5.
- 92 Heraclitus Fr. 67. Cf. Fr. 102: 'To God all things are fair and good and just, but men hold some things wrong and some right.'
- 93 KRS p. 191.
- 94 Heraclitus Fr. 94.
- 95 So, e.g. all Euclidean triangles have internal angles adding up to 180 degrees.
- 96 See Gregory (2008) on this issue.
- 97 Heraclitus Fr. 78.
- 98 See Heraclitus Fr. 79, 82, 83.
- 99 Heraclitus Fr. 36: 'For souls it is death to become water', Fr. 118: 'A dry soul is wisest and best.'
- 100 Heraclitus Fr. 25. Cf. Fr. 136.
- 101 Betegh (2004), Laks and Most (1997), Kouremenos, Paraassoglou and Tsantsanoglou (2006), Bernabe (2002). There are some quite diverse views on the Derveni papyrus,

the text in many places is damaged and reconstruction of it is hypothetical. Translation is often either difficult or contested and interacts with hypothetical reconstruction of the text. Throughout I am working from Betegh's text.

- 102 Derveni papyrus, Col. 7, 3–6, trans. Betegh.
- 103 Derveni papyrus, Col. 10, 11–13. Cf. Derveni papyrus, Col. 9 and Col. 13, 3–5: 'In all of his poetry he speaks about things enigmatically.'
- 104 For an overview of more detailed accounts of the Derveni author and his scheme, see Kouremenos, Paraassoglou and Tsantsanoglou (2006) pp. 45ff.
- 105 Derveni papyrus, Col. 14, 6.
- 106 Kronos gets his name according to the Derveni author from the Greek etymology from being the mind which strikes things together, while Zeus is referred to as 'wise' Zeus.
- 107 Derveni papyrus, Col. 15, 6.
- 108 The Derveni author also sees many names for a single god: Col. 22, Col. 23.
- 109 Derveni papyrus, Col. 19, 1–15. Cf. Derveni papyrus, Col. 17: 'Air existed before the things that are now were set together and air always will exist. For air is not born, but always exists. The reason why air has its name has been made clear. However, it was thought that it was born because it had the name Zeus, as if it did not exist beforehand. And he said this will be last, since it was named Zeus and this will continue to be its name, until the things that are now have been set together in the floating form in which they previously were.'
- 110 Derveni papyrus, Col. 16, 6–10, Col. 21, 13ff., cf. Col. 17 on air always existing. This would seem to place the Derveni papyrus firmly in a post-Parmenides context.
- 111 Derveni papyrus, Col. 9, cf. Col. 17. As Betegh (2004) pp. 224–5, 227ff. has suggested, it may be best to think of this as a hot, fluid state with the fluid in motion.
- 112 Derveni papyrus, Col. 15, 3–4, cf. Col. 13, possibly Col. 14, 1–2 as well. The stars are of the same matter as the sun but are dispersed around the heavens. They are constrained so that they do not come together to form another sun; Derveni papyrus, Col. 25.
- 113 See Derveni papyrus Col. 13, 16, 20.
- 114 Derveni papyrus Col. 13. Cf. Kouremenos, Paraassoglou and Tsantsanoglou (2006) pp. 28ff.
- 115 It is notable that in Col. 25 there is a single god and a cosmogony (not sexually based), where Zeus has demiurgic rather than sexual activity.
- 116 Derveni papyrus, Col. 12, 2.
- 117 Derveni papyrus, Col. 12, 3.
- 118 It is worth noting here that chance plays no part in Heraclitus' cosmology.
- 119 Derveni papyrus, Col. 4, 5–6.
- 120 Heraclitus Fr. 89. Col. 4 goes on to give us an independent source Heraclitus Fr. 94.
- 121 Derveni papyrus, Col. 4, 7–9.
- 122 Heraclitus Fr. 3.
- 123 Heraclitus Fr. 94.
- 124 Derveni papyrus, Col. 9, 5–8.
- 125 Derveni papyrus, Col. 25 lines 9–12. Cf. Col. 15: 'Colliding them with each other, he made the sun separate, the things that are standing apart from each other. For as the sun became separated and encircled, he coagulated and held fast both the things that are above and those that are below the sun.'

- 126 See Derveni papyrus, Col. 10, 11–13, quoted above.
- 127 See Derveni papyrus, Col. 20.
- 128 Betegh (2004) p. 355.
- 129 My view here is the same as with the Hippocratics – we get something more than mechanistic explanation but that is not problematic, in either the Hippocratic corpus or the Derveni papyrus.
- 130 See Betegh (2004) p. 357.
- 131 See Anaximander in Aristotle, *Physics* III/4, 203b7ff., Heraclitus Fr. 41, Fr. 64, Parmenides Fr. 12, Hippocratic author, *On Regimen* I/10, Diogenes of Apollonia Fr. 5 and cf. Plato, *Philebus* 28d, 30d.
- 132 Anaxagoras Fr. 12. Aristotle, *Metaphysics* I/3, 984b15 says: ‘Someone said that *nous* was present in animals and in nature, and was the reason for the arrangement and order of everything, and he seemed a sober man compared with the accounts that preceded him. Clearly we know that Anaxagoras held this account, though Hermotimus of Clazomenae stated it first. Those who thought in this manner supposed there to be a first principle which was the reason for the beauty of things, and also gave rise to motion.’
- 133 Hippolytus, *Refutation of all Heresies* 1, 8, 12.
- 134 Theophrastus, *History of Plants* III, 1, 4.
- 135 Broadie (1999) p. 206.
- 136 Pseudo-Plutarch III, 3, 4, trans. Curd. Cf. Aristotle, *Meteorology* II/9. Cf. Seneca, *Natural Questions* II, 12, 3.
- 137 Anaxagoras Fr. 19. Cf. Pseudo-Plutarch III, 5, 11, trans. Curd: ‘Anaxagoras says that the rainbow is a reflection of the sun’s radiance by a dense cloud, and that it is always placed right opposite the star that is reflecting. The so-called mock suns that occur in the region of the Black Sea are explained in nearly the same way.’
- 138 Scholium on Prometheus Bound, 88.
- 139 Stobaeus I, 31, 2. Trans. Curd. Cf. Aristotle, *Meteorology* I/12.
- 140 Pseudo-Plutarch III, 15, 4. Cf. Aristotle, *Meteorology* II/7, Seneca, *Natural Questions* VI, 9, 1, Ammianus Marcellinus XVII, 7, 11.
- 141 Aristotle, *Physics* IV/6, trans. KRS.
- 142 Plutarch, *Lives*, *Pericles* 12–14, trans. J. Dryden.
- 143 Identifying the exact nature of the Athenian plague has proved problematic as there is no exact correspondence to any known modern disease. See Hornblower (1991) pp. 316–17 for debate here.
- 144 Lloyd (1987) pp. 11–12, n. 31.
- 145 Finley (1972) p. 20.
- 146 Finley (1972) p. 20.
- 147 It can also be seen at V/104–5, where the Melians and the Athenians both claim to have the gods on their side.
- 148 Thucydides, *The Peloponnesian War* 2/54.
- 149 Thucydides, *The Peloponnesian War* 2/47.
- 150 See Diogenes Laertius, *Lives of the Philosophers* I, 110 and 112 on Epimenides.
- 151 Thucydides, *The Peloponnesian War* 1/23.
- 152 Hornblower (1991) p. 317. Cf. ‘However scientific we judge Th. to have been in these chapters, we should remember that there was more than one Thucydides.’
- 153 Thucydides, *The Peloponnesian War* 2/28.
- 154 Aristophanes, *Clouds*, 365ff.
- 155 Aristophanes, *Clouds*, 375ff.

- 156 Aristophanes, *Clouds*, 380ff.
- 157 Aristophanes, *Clouds*, 395ff.
- 158 Aristophanes, *Clouds*, 403ff.
- 159 Aristophanes, *Clouds*, 409ff.
- 160 There is humour concerning the traditional conception of the gods elsewhere as well.
- 161 See Dihle (1977), Scodel (1980), Kahn (1997).
- 162 Sisyphus fragment, DK 88 B25, trans. Kahn.
- 163 Especially as the character who delivers these lines, Sisyphus, is a trickster who comes to an unfortunate end at the hands of the gods.
- 164 Though this is not the only passage with such sentiments in Euripides: cf. *Bellerophon* Fr. 286. However, cf. Euripides Fr. 941, cf. Fr. 877 where aether is known to men by the name of Zeus.
- 165 Cf. Barnes (1982) pp. 456ff., Lloyd (1979) pp. 14–15.
- 166 Sextus, *Moralia* IX, 18, trans. Lloyd.
- 167 Euripides Fr. 910.
- 168 Cf. Naddaf (2005) on this passage.
- 169 Herodotus I, 105, 4.

Chapter Seven

- 1 Alkmaeon of Croton has been thought to be a Pythagorean but is now generally reckoned not to have been so and is not dealt with here.
- 2 It was recognised in antiquity that Pythagoras wrote nothing, e.g. Josephus, *Contra Apionem* 1, 163.
- 3 See e.g. Porphyry, *Life of Pythagoras* 19, Aristotle Fr. 192.
- 4 Pythagoras and the early Pythagoreans are difficult to deal with, because for Pythagoras, as KRS (p. 215) have noted and everyone else agrees, the evidence is peculiarly unsatisfactory.
- 5 Burkert (1972).
- 6 Huffman (1990), Zhmud (2012).
- 7 Cf. Barnes' caricature of the older position: 'Pythagoras, discoverer and eponym of a celebrated theorem, was a brilliant mathematician; by applying his mathematical knowledge, he made progress in astronomy and harmonics, those sister sirens who together compose the music of the spheres; and finally, seeing mathematics and number at the bottom of the master sciences, he concocted an elaborate physical and metaphysical system and propounded a formal, arithmological cosmogony. Pythagoras was a Greek Newton; and if his intellectual bonnet hummed at times with an embarrassing swarm of mystico-religious bees, we might reflect that Sir Isaac Newton devoted the best years of his life to the interpretation of the number symbolism of the book of Revelations.' Barnes (1979) pp. 100–1.
- 8 Plato, *Republic* 531a, 600a, *Sophist* 242c, Aristotle *Metaphysics* I/v, *De Caelo* II/xiii.
- 9 Plato, *Republic* 600b.
- 10 Plato *Republic* 531a, *Timaeus* 35b, Aristotle, *De Caelo* II/9.
- 11 These tales are alarmingly pernicious in literature outside of Pythagorean specialists – see Dudley (1997) pp. 2–4 as a critique of Bell (1933).
- 12 So, for instance, the view of Cornford (1922) p. 139 on Pythagoras looks a little odd 90 years on in the light of modern historiography: 'In a man of this temper,

presenting an extremely rare combination of the highest spiritual and intellectual force, the religious motive, by its very nature, must be stronger than scientific curiosity?

- 13 Zhmud (1997 and 2012) makes the best case for discovery by Pythagoras and asks the key question: if not Pythagoras, then who did discover this theorem?
- 14 Burkert (1972) has the most sceptical view of Pythagoras in this respect, see Vogel (1966), Rowett (2011) and Zhmud (2012) for other views.
- 15 Zhmud (1997).
- 16 Huffman (1989).
- 17 Zhmud (1989) p. 279, (2012) p. 13, Huffman (1989) pp. 4, 8, 11.
- 18 Philolaus Fr. 1.
- 19 Zhmud (1989) p. 284. The Aristotle passages are *Metaphysics* 986a16, 987b28 and 1083 b11, *Metaphysics* 985b27 and 987b11, *Metaphysics* 986a2, 986a18.
- 20 See Zhmud (2012) p. 395, cf. Huffman (2007) pp. 67–74.
- 21 Pseudo-Plutarch I, 3, 8.
- 22 See e.g. Aristotle, *De Caelo* II/9.
- 23 Barker (1984) p. 20.
- 24 Zhmud (2012) p. 290.
- 25 Porphyry, *Commentry on Ptolemy's Harmonics* 30.1, trans. Mueller.
- 26 See e.g. Burkert (1972) pp. 374–5.
- 27 These were known to the ancient Greeks.
- 28 See Huffman (1999).
- 29 So see e.g., Whitehead (1925) p. 41, Dodds (1951) pp. 143ff.
- 30 Kahn (2001) pp. 34–8 and Riedweg (2005) pp. 73–90, see objection from Huffman (2007) p. 21.
- 31 Zhmud (2012) is very good on many of the issues here.
- 32 On the origins of metempsychosis see Zhmud (2012) p. 222.
- 33 Xenophanes Fr. 7.
- 34 See Huffman (2007) p. 21, Burkert (1985) p. 300, Kahn (2001) p. 18. One issue here is that there is no evidence for metempsychosis in Egypt other than the suggestion that this is where Pythagoras got the idea.
- 35 Homer, *Odyssey* XI/489.
- 36 Cf. Huffman (1999) pp. 70–1.
- 37 Huffman (2007) p. 24, pp. 39–41 and n. 54.
- 38 Meno, DK44A27.
- 39 Stobaeus I, 18, 1, cf. Aristotle, *Physics* IV/6, 213b24–29: The Pythagoreans asserted the existence of the void, and held that it enters the heavens from the unlimited breath, so breathing the void, which demarcates natural things, forming a void space or distinction between things which are in succession. It is this void which distinguishes their nature; Pseudo-Plutarch II, 9, 1: The Pythagoreans say that outside of the *kosmos* there is a void, into and out of which the *kosmos* breathes; and Simplicius, *Physics* 651, 26.
- 40 Barnes (1982) p. 111.
- 41 Heraclitus Fr. 40.
- 42 Heraclitus Fr. 129.
- 43 Cf. Zhmud (2012) p. 34.
- 44 Heraclitus Fr. 81.
- 45 Freeman (1948) p. 30.
- 46 Kahn (1979) p. 114.

- 47 Huffman (1999) p. 71, cf. Zhmud (2012) p. 37.
- 48 Dodds (1951) pp. 143ff.
- 49 Burkert (1972) pp. 162ff.
- 50 Cornford (1952).
- 51 Kingsley (1994).
- 52 Huffman (1999) p. 73.
- 53 Bremmer (1983).
- 54 Zhmud (2012) pp. 208ff.
- 55 KRS (1982) p. 229.
- 56 Dodds (1951) viii. It should also be noted that recent studies of shamanism have questioned whether shamanism is exclusive to hunter-gatherer societies and have concluded that it is not. See Klein, Guzman and Stanfield-Mazzi (2005).
- 57 Kingsley (1994).
- 58 Zhmud (2012) pp. 210ff.
- 59 See Zhmud (2012) p. 210.
- 60 Here I mean 'charismatic' in the common sense of an attractive leader rather than the more specific Christian sense of someone having gifts given by God.
- 61 See <http://oxforddictionaries.com/definition/english/shaman?view=uk>
- 62 Walsh (1989) p. 2.
- 63 Shirokogoroff (1935) p. 269.
- 64 Walsh (1989) p. 5.
- 65 Jolly (2005) p. 127. Cf. the reply by Klein, Guzman and Stanfield-Mazzi (2005).
- 66 Riedweg (2002) pp. 60ff. uses the term 'Guru' which again is fine in its looser associations but problematic if pushed harder. More precise is Reidweg (2002) p. 60 and the suggestion that Pythagoras fits well into Weber's sociological analysis of 'charismatic'.
- 67 Kirk, Raven and Schofield (1982) pp. 221–2.
- 68 Aristotle, *Posterior Analytics* 942b32.
- 69 Aristotle Fr. 191.
- 70 Porphyry, *The Life of Pythagoras* 41 = Aristotle Fr. 196.
- 71 Aristotle, *Metaphysics* I/8, trans. Ross.
- 72 Aristotle, *Metaphysics* I/8, trans. Ross.
- 73 Aristotle Fr. 191.
- 74 Aristotle Fr. 191.
- 75 Kingsley (1995) p. 283, cf. Dodds (1951) p. 110.
- 76 Aristotle Fr. 195 lists six reasons, see also Grmek (1989) pp. 210ff. on possible medical reasons.
- 77 See Zhmud (2012) pp. 236–8.
- 78 Kingsley (1995) p. 293.
- 79 Kingsley (1995) pp. 292ff.
- 80 See Zhmud (2012) pp. 172–3.
- 81 Cornford (1922) p. 139.
- 82 Philolaus Fr. 1.
- 83 Philolaus Fr. 2.
- 84 Philolaus Fr. 3.
- 85 Philolaus Fr. 4.
- 86 This is raised as a possibility by Huffman (2007) p. 31, while Zhmud (2012) pp. 207ff. flatly denies that Philolaus ever believed in metempsychosis, a view also held by Burnet (1914) and Wilamowitz (1920).

- 87 Netz (2005) p. 91.
- 88 Plato, *Phaedo* 61d–e.
- 89 Plato, *Phaedo* 86bff.
- 90 Philolaus Fr. 13.
- 91 Guthrie (1962), p. 319.
- 92 Huffman (2007) pp. 33 and 40, n. 54.
- 93 See Barker (1989).
- 94 See Philolaus Fr. 6a.
- 95 Modern music uses something called twelve tone equal temperament (12ET) where there are equal ratios between the twelve semi-tones making up an octave, that ratio being the twelfth root of two.
- 96 Aristotle, *On the Heavens* II/13, trans. Stocks.
- 97 Huffman (1993) pp. 241ff.
- 98 Kahn (2001) pp. 29–30.
- 99 Graham (2012).
- 100 See Gregory (2000).
- 101 Simplicius, in *De Caelo* 504.17–20.
- 102 Both accepted by virtually all models which follow – I have argued that the great contribution of Plato's model is the idea of planetary motions as combinations of regular circular motions, see Gregory (2000, 2003).
- 103 Simplicius, in *De Caelo* 504.17–20ff. Philolaus' model of course has other deficiencies, and while these phenomena could in principle be accounted for on grounds that sun, moon and planets all have variable distances from the earth, whether the quantitative phenomena could be reproduced is another issue.
- 104 Aristotle, *Metaphysics* II/5, *De Caelo* II/13.
- 105 Proclus, *Commentary on Euclid* 130.8.
- 106 Huffman (1993) pp. 385–91, Kingsley (1994) pp. 294–6.
- 107 Bouch-Leclercq (1979) and Neugebauer (1951).
- 108 Huffman (1993) pp. 385–91.
- 109 Huffman (1993) pp. 389–90.
- 110 Kepler (1601), translated by Brackenridge and Rossi (1979).
- 111 Kepler in Brackenridge and Rossi (1979) pp. 4ff.
- 112 Kepler in Brackenridge and Rossi (1979) pp. 36ff.
- 113 Kepler, *Harmonices Mundi*, KGW 6:397. Carl Sagan described Kepler as 'The first astrophysicist and the last scientific astrologer.' Quote from Carl Sagan, *Cosmos: A Personal Voyage*, episode III: *The Harmony of the Worlds*.
- 114 There were many works forged in Archytas' name in late antiquity.
- 115 Plato, *Republic* 530d.
- 116 Huffman (2005).
- 117 Archytas Fr. 1.
- 118 Archytas Fr. 4.
- 119 Simplicius, *Physics Commentary* 467, 26ff.
- 120 See Heath (1921), Mueller (1997), Huffman (2005).
- 121 L is in proportion to a, as a is to b, as b is to 2L.
- 122 See Barker (1989), Huffman (2005).
- 123 In fact the speed of sound is a constant for a given medium and it is frequency that is critical to pitch, how rapidly a string vibrates determining the frequency rather than the speed of the sound.

- 124 In modern twelve tone equal temperament, all twelve tones in the chromatic scale are equally spaced, the ratio being the twelfth root of 2.
- 125 See Barker (1989) p. 50, Huffman (2005) pp. 63–4 and 419–20.
- 126 Plato, *Republic* 531c. Cf. Plato, *Republic* 531a: ‘By the gods, they are amusing – they speak of something closely ordered and they lay their ears alongside, as if they were trying to catch voices from next door. Some claim to hear a note between, establishing the existence of something smallest, to be used for measurement, while others say these sounds are alike, both using their ears rather than their minds.’
- 127 Cf. Huffman (2005) pp. 423–4, Barker (1989) p. 52.
- 128 Archytas A17 is sometimes taken as being ‘mystical’ about the relation of mathematics and music, but with Huffman (2005) pp. 430–1, I take this fragment to be about Archytas’ predecessors and not about Archytas himself, against Burkert (1972) and Mueller (1997).
- 129 Kingsley (1995) p. 292.
- 130 Zhmud (2012) p. vi.
- 131 Nor do I give any great significance to the fact that some early Pythagoreans hypothesised a mobile earth, on the basis that that is ‘nearer to’ modern science or that it had an influence on Copernicus.

Chapter Eight

- 1 Burkert (1972) pp. 465ff.
- 2 Burkert (1972) p. 466.
- 3 Burkert (1972) p. 468, quoting Levi-Bruhl (1951) p. 236.
- 4 Burkert (1972) pp. 466–74. Burkert refers to these cultures as primitive, I do not.
- 5 Burkert (1972) pp. 474–6.
- 6 Burkert (1972) pp. 479–80.
- 7 Burkert (1972) p. 476.
- 8 Cf. Kingsley (1995) p. 292, n. 12.
- 9 Burkert (1972) p. 335. Cf. Pedersen (1974) p. 26: ‘In many ways, the Timaios reflects an animistic and anthropomorphic philosophy foreign to the Ionian philosophers’ fundamental attitude, although there are a few similar ideas.’
- 10 See Gregory (2000) Chapter 6.
- 11 Pythagorean numerology was organized by Greek philosopher and mathematician Pythagoras, who combined the mathematical disciplines of the Arabic, Druid, Phoenician, Egyptian, and Essene sciences. Since then, it has continued to evolve. The Pythagorean system is today the most commonly used system of numerology in the West. See <http://www.decoz.com/pythagoras.htm>
- 12 The Greek and Hebrew number systems used letters, which makes the association between letters and numbers easier to establish, rather than the system of Arabic numerals separate from letters as in modern Western systems.
- 13 Pythagorean numerologists, like McCants, break their calculations into numerals one through nine, by adding numbers again and again until a single digit remains. Some numbers mix; others don’t, she explained. The numbers 3, 6 and 9 naturally match – as do 1, 5 and 7 or 2, 4 and 8. See http://www.nytimes.com/2007/06/10/fashion/weddings/10field.html?_r=1
- 14 See <http://www.skeptdic.com/numology.html>. The sceptics dictionary continues:

'Since there are no occult meanings to numbers and since numbers by themselves can have no significant influence on anyone's life, numerology is nothing but superstition masquerading as science or art.'

15 See <http://www.skepdic.com/numology.html>

16 Stove (1991) Chapter 7.

17 Atomic weight was a known property, so when Mendeleev occasionally placed elements out of atomic weight sequence better to group them by properties, this seemed arbitrary. Actually the table is a sequence of atomic number (number of protons in the nucleus) complicated by the fact that atomic weight is different but related, depending on the number of neutrons in the nucleus as well.

18 Other more recent versions of the large number hypothesis have used 10^{60} , 10^{80} or 10^{120} .

19 It should be noted that important theoretical physicists and cosmologists worked on the idea, such as Dirac, Eddington and Milne.

20 One might also look at Arthur Eddington's attempt to derive the value of the fine structure constant from purely mathematical considerations as another modern example of a borderline between mathematical physics and numerology.

21 In particular here there is something known as the Elliott Wave Theory which attempts to model and predict the behaviour of the stock market. See Dudley (1997) pp. 295ff.

22 One concern here would be a strategic concern of this book, whether it is proper to characterise magical disciplines as failed science.

23 Zagier, in Havil (2003) p. 171: 'There are two facts about the distribution of prime numbers of which I hope to convince you so overwhelmingly that they will be permanently engraved in your hearts. The first is that, despite their simple definitions and role as the building blocks of the natural numbers, the prime numbers belong to the most arbitrary and ornery objects studied by mathematicians: they grow like weeds among the natural numbers, seeming to obey no other law than that of chance, and nobody can predict where the next one will sprout. The second fact is even more astonishing, for it states just the opposite: that the prime numbers exhibit stunning regularity, that there are laws governing their behaviour, and that they obey these laws with almost military precision.'

24 See e.g. Delattre (1998) p. 139 and cf. Zhmud (2012) p. 300.

25 One might argue that this too is something that we do not find in, or in relation to associative numerology in earlier cultures.

26 Aristotle, *Metaphysics* I/5, trans. Ross, cf. Aristotle, *On the Heavens* II/13 and Aristotle, *On the Heavens* III/1, trans. Stocks: 'The same consequences follow from composing the heaven of numbers, as some of the Pythagoreans do who make all nature out of numbers.'

27 Aristotle, *On the Heavens* II/9, trans. Stocks. Cf. Aristotle, *On the Heavens* II/9, trans. Stocks: 'The very difficulty which made the Pythagoreans say that the motion of the stars produces a concord corroborates our view. Bodies which are themselves in motion, produce noise and friction: but those which are attached or fixed to a moving body, as the parts to a ship, can no more create noise, than a ship on a river moving with the stream.'

28 Aristotle Fr. 13, trans. Zhmud.

29 See Plato, *Republic* 616b–617d.

30 Plato, *Republic* 617b.

31 I do not present cosmic numerology as the whole of Pythagorean numerology.

32 Here I take a conscious decision to investigate whether there are interesting affinities between Plato, particularly in the *Timaeus*, and Philolaus. In this, my approach is more in sympathy with Huffman (1993) than Kingsley (1995).

- 33 I take it that Taylor's (1928) 'Pythagorean' account of the *Timaeus* has been refuted by Cornford (1937). There are others though who still find a significant Pythagorean aspect in Plato's cosmology.
- 34 I also reject Kennedy's view (Kennedy (2010)) that Plato structured his dialogues in a music-related format and that we can see Pythagorean theory embedded in Plato's dialogues; see Gregory (2012).
- 35 Plato, *Phaedo* 86bff.
- 36 See Simplicius, *Commentary on Aristotle's Physics* 467, 26.
- 37 See Aristotle, *de Caelo* 293a18ff., Aetius II, 7,7ff.
- 38 See Popper (1945) p. 248, n. 9 and (1952) pp. 87ff., also Wright (1995) p. 54, Popper (1952) p. 88. It has been argued, most notably by Popper, that in response to the difficulties of the Pythagorean programme Plato advocated geometrical rather than arithmetical means for the description and explanation of the world. Popper comments that one of Plato's main contributions is that: Ever since, but not before, geometry (rather than arithmetic) appears as the fundamental instrument of all physical explanations and descriptions, in the theory of matter as well as cosmology.
- 39 See Aristotle, *de Caelo* III/1.
- 40 Aristotle, *Metaphysics* I/5, 986a.
- 41 Plato, *Timaeus* 35c.
- 42 Plato, *Timaeus* 36d.
- 43 Plato, *Timaeus* 35d.
- 44 See Kingsley (1995) pp. 174ff., Zhmud (2012) pp. 407–8.
- 45 Kingsley (1995) p. 177 suggests that this is not arbitrary or an error on Aristotle's part, but due to his perception of how the academy transformed and modernised Pythagorean ideas.
- 46 Though there is a wider debate here as Plato's supposed 'unwritten doctrines' play little part in my interpretation of Plato.
- 47 Kingsley (1995) p. 178 argues that Aristotle's comment on 'people who look for proof in theoretical arguments rather than the phenomena' fits Platonists better than anyone else, rather than the early Pythagoreans. This is too broad an argument to enter here, but this is not my impression of Plato generally (even in *Republic* VII) or Plato in the *Timaeus* specifically. See Gregory (1996 and 2000).
- 48 Cf. Plato, *Philebus* 17c.
- 49 See Gregory (2013).
- 50 Remarkably, he gets very good results, accounting for the orbits of the planets within the bounds of observational error for the time.
- 51 Kepler used factors such as planetary speed at either end of the ellipse's major axis to generate ratios that could then be manipulated and interpreted musically. There is no conflict between Kepler's ellipses and the spheres he used for planetary spacing – he took the mean values of the ellipse to generate the spheres for this purpose.
- 52 Leibniz (1689).
- 53 Simplicius, *Physics* 28, 8 tells us that: Leucippus supposed there to be an infinite number of atoms that are always in motion and have an infinite number of shapes on the grounds that nothing is such rather than such (*dia to meden mallon toiouton ê toiouton einai*).
- 54 Plato, *Timaeus* 53d4–54a6 says that: "This we hypothesise as the principle of fire and of the other bodies ... but the principles of these which are higher are known only to God and whoever is friendly to him. It is necessary to give an account of the nature of the four best (*kallista*) bodies, different to each other, with some able to be

- produced out of the others by dissolution ... We must be eager then to bring together the best (*kallei*) four types of body, and to state that we have adequately grasped the nature of these bodies. Of the two triangles the isosceles has one nature, the scalene an unlimited number. Of this unlimited number we must select the best (*kalliston*), if we intend to begin in the proper manner. If someone has singled out anything better for the construction of these bodies, his victory will be that of a friend rather than an enemy. We shall pass over the many and postulate the best (*kalliston*) triangles.'
- 55 I do not wish to air the vexed question of how much humans can know about the world about us here in the *Timaeus*, but without good mathematical structure Timaeus would be unable to give his account.
- 56 See Westman (1984), Rosen (1984) and Field (1984).
- 57 Philolaus Fr. 1, cf. Fr. 2, esp. 'it is clear that the cosmos and the things in it were fitted together by limited and unlimited things.'
- 58 Or indeed whether it fitted itself together in the manner of the Milesians.
- 59 Philolaus Fr. 7.
- 60 One might object to the notion of the cosmos being thought of as a good arrangement, or more strongly as a best arrangement, prior to Plato. The notion of good arrangement is strongly enough built into the attested meanings of *cosmeô* and *diacosmeô* and their cognates for the notion of a good cosmos to be unproblematic. Best is of course more tendentious, but certainly it can be argued that is implicit in some of the unique cosmos cosmogonies of the presocratics and it is Plato who makes this consideration explicit. See Gregory (2007).
- 61 One might also note the various uses of *harmozô* and its cognates in Aristotle, *Metaphysics* I/5, *On the Heavens* II/13 and Aristotle Fr. 13 which we saw earlier on. Aristotle, *On the Heavens* II/9, trans. Stocks. Cf. 'The very difficulty which made the Pythagoreans say that the motion of the stars produces a concord corroborates our view. Bodies which are themselves in motion, produce noise and friction: but those which are attached or fixed to a moving body, as the parts to a ship, can no more create noise, than a ship on a river moving with the stream.' Aristotle, *On the Heavens* II/9, trans. Stocks. Aristotle Fr. 13.
- 62 Philolaus Fr. 6.
- 63 Philolaus Fr. 4, cf. Fr. 3, esp. 'there will not be anything that is going to know if everything is unlimited'.
- 64 Cf. Kingsley (1995) pp. 180ff.
- 65 One might note, e.g. that the sun, which determines the seasons, is the seventh orbit in the Philolaic scheme and that seven was associated with the seasons by the Pythagoreans (see Schofield 2012). The counter-earth would be the tenth orbit in. Note that in the Myth of Er in the *Republic*, Plato counts from the outside inwards as well.
- 66 It might be argued that all I have done is moved goalposts of what is acceptable and fitted the Pythagoreans into that if I did not recognise that the Pythagoreans had other types of numerology as well.
- 67 Cf. Schofield (2012) p. 155, Kahn (2001) p. 30.
- 68 One might also note that it is different from Aristotle's account of the relation of number to the world and different from a whole host of Renaissance thinkers such as Giordano Bruno and Robert Fludd.
- 69 Lloyd (1987) p. 276.
- 70 And with Zhmud and Huffman I would disagree that for the early Pythagoreans 'all is number'!
- 71 That Philolaus fits into this group ought to be no surprise given how he talks of the

cosmos and its origins in the fragments that we have, and the fact that his book seems to have been called *On Nature*, the standard title within the *periphrasis* tradition.

Chapter Nine

- 1 See Guthrie (1965) p. 124.
- 2 Kingsley (1995) p. 8; such an approach is 'not only inappropriate but completely untenable'.
- 3 Inwood (2001) p. 8: 'No two independent editors have assigned the same set of fragments to each.'
- 4 Inwood (2001) pp. 9ff.
- 5 Primavera (2008) pp. 250–1.
- 6 Plutarch, *Convivial Questions* 683e.
- 7 Aristotle, *Poetics* 1, 1447b17–20.
- 8 Empedocles Fr. 8, cf. Fr. 9, 13, 14, 17.
- 9 Empedocles Fr. 12.
- 10 Pseudo-Plutarch I/30.
- 11 Empedocles Fr. 135.
- 12 The usual Heraclitus comparison here is to Fr. 114, but Fr. 30 would be an interesting alternative.
- 13 Aristotle, *Meteorologica* II/9.
- 14 Seneca, *Natural Questions* III/24.
- 15 Empedocles Fr. 50.
- 16 I would agree with Graham (1988) p. 305 that: 'B17 must be read as more than an argument or a programme for an argument: it is also a mimetic structure which portrays the world condition which it describes' and p. 312: 'The verbal structure of the poem is after all not dispensable in the way that Aristotle thought it was, for it is in poetic form that Empedocles reveals the eternal recurrence of the cosmic cycle and its fearful symmetry.' Cf. Trepanier (2004) pp. 4ff. Such a strategy of relating literary form and argument has been successful for thinkers such as Parmenides, Heraclitus, Anaxagoras and Plato. Empedocles repeatedly uses the formula of one line describing association under the influence of love followed by another line on the influence of strife (five times in Fr. 17, but also in Fr. 20, 21, 22, 26). The effect of these line pairs is to emphasise the symmetrical functioning of love and strife in associating and dissociating the elements. These considerations weigh very strongly against any non-cyclical or non-symmetrical interpretations of Empedocles.
- 17 See Primavera (2008) pp. 253ff. for new evidence of the timing of the cycle.
- 18 Aristotle, *Metaphysics* III/4, 1000a26ff.: 'Empedocles posits strife as an explanatory principle for destruction, as strife is able to produce everything but the one, for all things except god come from it. He says "From these has come everything that was and is and will be. Trees, men and women have sprung up, beasts, birds and water-nurtured fish and the long living gods." This is clear even apart from this. If there had not been strife in things, all things would have been one, he says.'
- 19 Though see Primavera (2008) on new evidence for a significant period of total Strife.
- 20 Reading *anôtatô*, with Simplicius and most modern versions.
- 21 Aristotle, *Physics* II/4, 196a20ff. Cf. Aristotle, *Generation and Destruction* II/6, 334aff.: 'Although strife dissociates, it was not by strife that aether was carried upwards, but

- sometimes Empedocles speaks as if this were due to chance, saying “Thus at one time it ran by chance, but many times it was otherwise”, but he also says that it is the nature of fire to be carried upwards, and aether, he says “sank beneath the earth with long roots”
- 22 Aristotle says something very similar at *Physics* VIII/1, 252a17: ‘The natural is absolute, and not sometimes thus and sometimes otherwise. Fire is always carried upwards and not sometimes like this and sometimes in another manner. When nature is not absolute, there is proportion’, so we have three passages in Aristotle asserting this.
 - 23 Trepanier (2003) p. 418.
 - 24 Empedocles Fr. 98.
 - 25 Empedocles Fr. 96, Simplicius, *Physics* 300, 21, KRS translation. Cf. Empedocles Fr. 75: ‘Of those which are compact within and loosely formed outside, having chanced on this flaccidity in the hands of Kupris.’
 - 26 Wright (1995) p. 210 detects an adaptation of Home’s phrasing on bones: see *Iliad* XXIV/793.
 - 27 Pseudo-Plutarch V, 19, 5.
 - 28 Empedocles Fr. 57.
 - 29 Empedocles Fr. 61, Aelian, *Nat. Anim.* XVI, 29.
 - 30 Empedocles Fr. 59.
 - 31 Aristotle, *Physics* II/8, 198b29ff. Cf. Empedocles Fr. 103: ‘There by the desire of chance all things are sentient’ and Empedocles Fr. 104: ‘The best have fallen together by chance.’ See also Aetius 5, 18, 1: ‘When the human race was first generated from out of the earth, the day was of the length that ten months are now, owing to the slowness of the sun’s advance. As time went on, it became the length of seven months.’
 - 32 Furley (1987) p. 79 praises Empedocles for ‘The postulation of two physical forces, qualitatively different from each other.’
 - 33 Cf. Guthrie (1965) pp. 156–7 and Dodds (1951) pp. 145–6.
 - 34 See Gregory (2007) Chapter 5, section XIV.
 - 35 It is also noteworthy that neither Plato nor Aristotle attribute any form of teleology to Empedocles.
 - 36 Empedocles Fr. 86: ‘From these Aphrodite produced untiring eyes.’ Empedocles Fr. 84: ‘As when someone intending to go forth on a journey prepares a lamp for himself, a fire burning through the night of winter, fitting linen screens as protection from assorted winds, which stop the blast of the blowing winds, but the finer light escapes, and shines across the threshold with unfailing beams. In the same manner elemental fire, wrapped in membranes and delicate flesh was concealed in the round eye.’ Cf. Empedocles Fr. 87 and Fr. 95.
 - 37 Kingsley (1995) p. 298.
 - 38 Plotinus, *Enneads* 4, 4, 40. See my discussion of sympathy in the introduction to this book.
 - 39 Aristotle, *Metaphysics* III/4, 1000b10ff.
 - 40 Trepanier (2010) p. 305.
 - 41 Empedocles, *Strasbourg Papyrus*, ensemble a.
 - 42 Simplicius, *Physics*, 33, 12–17.
 - 43 Cf. Trepanier (2010) p. 307: ‘The Physics included long-lived gods as regular members of the current world’s fauna.’
 - 44 Primaversi (2008) p. 256.

- 45 Primaversi (2008) pp. 256–7.
- 46 Cf. Trepanier (2010) p. 305.
- 47 Primaversi (2008) p. 257, cf. Chapter 6, on the Derveni papyrus.
- 48 Empedocles, Fr. 111.
- 49 Cf. Kingsley (1995) p. 222.
- 50 Hippocratic author, *On the Sacred Disease* IV, 10–16. Cf. *On the Sacred Disease* IV, 1–4: ‘For they can bring down the moon, eclipse the sun, make storm and good weather, rain and drought, the sea impassable and the earth barren, and all the other such things.’
- 51 Kingsley (1995) p. 221. See his p. 221, n. 13 for some parallels with magical texts.
- 52 Diels (1903) p. 140. Cf. Kingsley (1995) p. 219.
- 53 That Gorgias, a pupil of Empedocles, is reported to have seen Empedocles performing magic (Diogenes Laertius VIII/59) is difficult to assess as we do not know if the alleged magic was natural or not.
- 54 Betegh (2004) p. 358, Betegh’s italics.
- 55 Kingsley (1995) pp. 225–6 argues for the latter and compares it to the work of a shaman.
- 56 There are two definite references to Empedocles’ medical writings, Diogenes Laertius, *Lives of the Philosophers* VIII, 77, and Suda (DK31A2). Two possible references are Aristotle, *Poetics* 1447b16 and Pliny, *Natural History* XXXVI, 69, 202. Galen, *On the Method of Healing* I, 1 also seems to consider Empedocles to have been a doctor.
- 57 Curd (2005) p. 13. Cf. Longrigg (1993) p. 27: ‘Nowhere can there be found any recourse to supernatural agency to account for the origin of the world or the operation of cause and effect within it.’
- 58 Wright (1995).
- 59 Inwood (2001).
- 60 Kingsley (1995) p. 218.
- 61 Van Groningen (1956) pp. 47–61, see Kingsley (1995) p. 219 for comment.
- 62 Cf. Kingsley (1995) pp. 231–2.
- 63 See my Chapters 2 and 8.
- 64 Dodds (1951) p. 146.
- 65 Dodds (1951), Kingsley (1995).
- 66 Kingsley (1995) p. 41.
- 67 Guthrie (1965) pp. 246–7.
- 68 Perhaps simply road or route for *atarpos*, but LSJ gives short cut and there is possibly a sense here of the crowd grasping at Empedocles for quick fixes.
- 69 Empedocles Fr. 112.
- 70 Though usually *kerdos* in the plural for this sense of it.
- 71 The sense may then be that ‘cunning arts, wiles’ are hard to come by or take a long time to acquire and the crowd would like a short cut to them.
- 72 See my Chapter 5.
- 73 See e.g. Empedocles Fr. 11, 15.
- 74 Empedocles Fr. 113, see below.
- 75 Empedocles Fr. 146.
- 76 Empedocles Fr. 117. Cf. Empedocles Fr. 115, where those cast out by the gods have incarnations in all sorts of mortal forms.
- 77 *Poluphthereôn* here is ambiguous between dies many times or can be destroyed in many ways. Most commentators opt for the first translation, probably correctly given

- Empedocles' views on metempsychosis, though the ambiguity may be deliberate, emphasising how superior Empedocles is.
- 78 Cf. Empedocles Fr. 117, and cf. Hesiod, *Theogony* 793ff. for a similar tale of oath breaking and punishment. Depending on what the exiles get up to in Empedocles, there may also be similarities with the first people of the golden age who become daimons wandering the face of the earth in Hesiod, see *Works and Days* 121ff.
- 79 Empedocles Fr. 115.
- 80 Empedocles Fr. 147.
- 81 Empedocles Fr. 136.
- 82 Empedocles Fr. 139. Cf. Strasbourg Papyrus, ensemble d, 'Woe that the pitiless day did not destroy me first, before I did awful deeds with my claws for the sake of food.'
- 83 Empedocles Fr. 141. Laurel leaves are out too, see Fr. 140.
- 84 See Aristotle, *Meteorologica* II/9, Seneca, *Natural Questions* III/24, Empedocles Fr. 50.
- 85 Parmenides Fr. 8, 50–2.
- 86 Empedocles Fr. 17, 26. Cf. Fr. 35, 1–2: 'I shall turn back once more to the path of song recounted previously, as I draw off account upon account, in that way' which may be an allusion to Parmenides Fr. 6 where mortals wander on a backwards turning path, see also Guthrie (1965) pp. 138–9. The opening of Fr. 17 may also recall Parmenides – see here KRS p. 287.
- 87 KRS p. 285, have argued that Empedocles engaged with Parmenides, and he replied in a Heraclitean manner, lamenting the limitations of the senses but believing in an intelligent use of empirical information, the relevant fragments being Empedocles Fr. 2 and 3, Heraclitus 1, 55 and 107. Trepanier (2004) esp. pp. 178–9 has brought out some stylistic and intellectual affinities.
- 88 Cf. KRS p. 285. Heraclitus Fr. 125 may also be significant: 'Even the *kukeon* separates unless it is stirred.' The mix of wine, barley and cheese will separate very quickly unless there is strife to keep the mixture in motion. In the context of the actions of love though, Empedocles Fr. 34 talks of: 'Gluing together barley-meal and water.' This may be a reference to baking and to love being able to put together and hold together a mixture better than strife can.
- 89 Kingsley (1995) p. 224.
- 90 See Homer, *Odyssey* XI, 489.
- 91 One might try to argue that Pythagoras is misplaced in the canon of presocratic philosophers on the grounds that our earliest witnesses to that tradition, Aristotle and Plato, do not seem to consider Pythagoras to have been a philosopher. However both Aristotle and Plato do seem to consider Empedocles to be a philosopher and it is arguable that both consider his views significant as Aristotle talks of his views a good deal and Plato arguably alludes to Empedocles a great deal even if not mentioning him by name.
- 92 Even if we end up including Pythagoras and Empedocles, the fact that there is considerable debate and the outcome of that debate is not entirely clear confirms the need to look carefully on a case by case basis.
- 93 See Kingsley (1995) pp. 278ff.
- 94 See Kingsley (1995) pp. 289ff.
- 95 Primaversi (2008), Trepanier unpublished MS.

Chapter Ten

- 1 Sextus Empiricus, *Against the Mathematicians* IX/24.
- 2 Clement, *Protrepticus* 6, 68, 5.
- 3 Derveni papyrus, Col. 19 1–7.
- 4 Euripides Fr. 941, cf. Fr. 877 where aether is known to men by the name of Zeus.
- 5 Stobaeus 1, 29, 1.
- 6 Seneca, *Natural Questions* V/2.
- 7 Aristotle, *Meteorology* II/7, 365b1–7.
- 8 Pseudo-Plutarch IV, 1, 4.
- 9 Plutarch, *Convivial Questions* 733d.
- 10 Lactantius, *Institutiones Divinae* VII, 7, 9, cf. Pseudo-Galen, *History of Philosophy* 123 and Censorinus, *De Die Natali* 4, 9.
- 11 Pseudo-Plutarch III, 3. Cf. Pseudo-Plutarch: ‘Metrodorus, that a cloud is composed of a watery exhalation carried into a higher place.’
- 12 See Cicero, *Academica* II, 23, 73, cf. Diogenes Laertius IX, 58.
- 13 Democritus Fr. 9.
- 14 See Aristotle, *de Anima* 403b30.
- 15 Democritus Fr. 297.
- 16 Pseudo-Plutarch IV, 7, 4.
- 17 Pseudo-Plutarch IV/19, the quotation is Homer, *Odyssey* XVII/218.
- 18 Homer, *Odyssey* XVII, 218.
- 19 See here Berryman (2009) pp. 34ff.
- 20 Berryman (2009) pp. 34ff., cf. Furley (1987) p. 13.
- 21 Fontenelle, *The Plurality of Worlds*.
- 22 Locke, *Essay Concerning Human Understanding* 4.3.25.
- 23 Cf. Berryman (2003).
- 24 Plato’s *Timaeus* too advocates a like-to-like principle, though Plato is critical of cosmogony based on this alone, as for him the cosmos is a harmonious blend of opposites, something highly unlikely to be produced from a like-to-like principle alone. Plato, *Timaeus* 53a: ‘In the same way at that time the four kinds were shaken by the recipient, whose motion was like that of an instrument for shaking, and separated the most unlike kinds furthest from each other and forced together the most like kinds, so that the different kinds had different regions, even before the universe was organised out of them.’ However, if this winnowing effect does take place, there seems to be no limit on it so eventually we would reach a situation where the four elements are separated out, especially if there is no limit to the amount of duration prior to the formation of the *kosmos*.
- 25 Democritus Fr. 164, Sextus Empiricus, *Against the Mathematicians* VII, 116–18.
- 26 Metrodorus of Chios, KRS translation.
- 27 Epicurus, *Letter to Pythocles* 89, 6–11: ‘Cosmos formation occurs when the appropriate seeds flow in from one cosmos or an intercosmos or from many. Gradually, by additions and joinings and migrations to another place, as may occur, and appropriate irrigations of this matter, a state of completion and permanence is reached, which lasts while the underlying foundations are capable of being added to.’
- 28 Reading *epekkrusin* here with the MSS tradition (the alternative being *epekkrisin*, see KRS), I disagree with KRS’s ‘attraction’ here on two counts – there are no attractive forces for Leucippus and Democritus, only contact actions, and the vortex takes in whatever it touches (so there is no need to suppose attraction).

- 29 Diogenes Laertius IX, 31.
- 30 Stobaeus I, 22, 1e. Cf. Pseudo-Plutarch II, 7: 'Leucippus and Democritus say that a cloak or membrane surrounds the cosmos.'
- 31 Stobaeus I, 29, 1.
- 32 Aelian, *The Nature of Animals* XII/18.
- 33 Anaximander's use of a bark simile in cosmogony would be an interesting parallel. Pseudo-Plutarch, *Stromateis* 2: 'He (Anaximander) says that which is productive out of the eternal hot and cold was separated at the genesis of this *kosmos*, and that a sphere of flame was formed around the air around the earth like the bark around a tree. When this was broken off and enclosed in certain circles, the sun, moon and stars were formed.'
- 34 Democritus Fr. 164, Sextus Empiricus, *Against the Mathematicians* VII 116–18.
- 35 Theories of gravitation based on vortices (e.g. Descartes) were based on vortex action (the observed effect being that a whirlpool will drag objects into its centre), and such theories survived into the eighteenth century, until a determination of the shape of the earth confirmed Newtonian ideas (Newton's theory of gravity predicted an earth slightly bulged at the equator and flattened at the poles, the Cartesian theory vice versa).
- 36 Cf. Pseudo-Plutarch IV/19.
- 37 Plato's *Timaeus* is an interesting parallel here. Plato too advocates a like-to-like principle, but requires specific types of motion for this to work. In the pre-cosmic chaos, it is the fact that the receptacle shakes like a winnowing basket that produces a separation of like to like, not just the general chaotic motion. At *Timaeus* 57c and 88de we are told that this shaking continues in the *kosmos*. At *Timaeus* 58aff. we are told of the compressive effect which the rotation of the *kosmos* has on the elements, making them intermingle. There is no universal attraction of like to like, nor is there any force which operates at a distance. Similarly at *Timaeus* 80bc electricity and magnetism are explained as due to contact action and mutual replacement, and there is an outright denial that any attraction is involved.
- 38 LSJ give 'without quality or attribute' for *apoios*.
- 39 Stobaeus I, 16, 1. For further evidence, see e.g. Aristotle, *Metaphysics* I/4, 985b4ff., *Generation and Corruption* I/8, 325a2ff., Simplicius, *De Caelo Commentary* 242, 18ff.
- 40 Pseudo-Plutarch I, 13, 8: 'Democritus said there were two, size and shape, while Epicurus supposed there to be a third, weight.' Stobaeus I, 14, 1: 'Democritus said of the primary bodies (they being the solids) that they do not have weight and are moved by mutual blows in the unlimited.'
- 41 On the eternity of the universe for Leucippus and Democritus, see Aristotle, *On the Heavens* 300b8, Cicero, *De Finibus* I, 6, 17, Pseudo-Plutarch, *Miscellanies* 7.
- 42 One reasonable objection to this line of thinking is that it is too modern and unlikely to have occurred to any ancient thinker, however there are parallels in Aristotle, Plato and Empedocles.
- 43 One might suggest that we think in terms of a different analogue, that of the motion of the sea and the sorting of pebbles. The motion in the void is random like the motion of the sea, so perhaps we get like to like? However, it is not the sea that is the analogue, but the waves and we do not get wave-like motion in the void.
- 44 I discuss the nature of like to like for Leucippus and Democritus in much greater detail in Gregory (2013).
- 45 Sextus Empiricus, *Against the Mathematicians* IX, 42.
- 46 Sextus Empiricus, *Against the Mathematicians* IX, 19.

- 47 Taylor (1999) p. 211.
- 48 Vlastos (1945) p. 581, n. 24.
- 49 Cicero, *On the Nature of the Gods* I, 12, 29, I, 43, 120 and II, 30, 76.
- 50 Taylor (1999) pp. 215–16.
- 51 Taylor (1999) pp. 215–16.
- 52 Barnes (1979) p. 460. LSJ give image in the mind, idea, phantom of the mind, fancy, for this sense of *eidôlon*.
- 53 Taylor (1999) p. 211.
- 54 Stobaeus I, 1, 29b, St. Cyril.
- 55 Cf. the lists of who believed in one cosmos and who believed in many in Stobaeus and Pseudo-Plutarch. See Gregory (2007) Chapter 2.
- 56 Ghosts of men: *Odyssey* XI, 83, 213, 476; XXIV, 14; *Iliad* XXIII, 72, 104; Phantoms: *Iliad* V, 451; Wraiths: *Odyssey* IV, 796, 824, 835.
- 57 Hesiod, *Theogony* 212 also has dreams being generated by the gods, this time dreams being the offspring of night.
- 58 Sextus Empiricus, *Against the Mathematicians* IX/24.
- 59 Plutarch, *On the Cessation of Oracles* 17, 419a.
- 60 I also take this as more likely than Democritus being confused or contradictory on these issues.
- 61 Democritus Fr. 112.
- 62 Democritus Fr. 37.
- 63 DK 67 A22. Trans. Trepanier.
- 64 Homer, *Odyssey* XVII/218.
- 65 Sextus Empiricus, *Against the Mathematicians* IX/24.
- 66 Such as the seventeenth-century mechanists' obsession with clockwork, or using only mechanical analogues for the processes of nature.

Chapter Eleven

- 1 Cf. Dodds (1951) pp. 179ff., Lloyd (1979) pp. 5ff.
- 2 I make no claim here to have been comprehensive or exhaustive on targeting in this work, merely to have picked out some of the more prominent and interesting examples.
- 3 At no stage have I deployed the argument that these religious beliefs were only held as a matter of convention or to guard against prosecution.
- 4 Hankinson (1998) p. 11.
- 5 That would certainly include Anaximander, the author of the Hippocratic *On Regimen*, in all likelihood Anaximenes and Diogenes of Apollonia as well.

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